MARCH 1961

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

UNIVERSITY MICROFILMS
313 N FIRST ST
ANN ARBOR MICH
P17

BETTER APPLIANCES WITH
Die Castings • Sinterings
Permanent Mold Castings

ALSO IN THIS ISSUE / Magnesium Investment Castings
Abrasive Belt Finishing of Long Extrusions

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

PMM

The magazine for design, finishing and the use of:

SINTERINGS • INVESTMENT CASTINGS • EXTRUSIONS
PLASTER MOLD CASTINGS • SHELL MOLD CASTINGS
PERMANENT MOLD CASTINGS • DIE CASTINGS

QUALITY CONTROL, STREAMLINED PRODUCTION METHODS...

...INSURE YOU UNIFORM QUALITY METAL, FREE FROM IMPURITIES AND GAS.

The most modern production equipment and methods in use, exacting scientific laboratory testing equipment, old-fashioned know-how . . . these are factors that are synonymous with Aluminum Smelting & Refining Company.

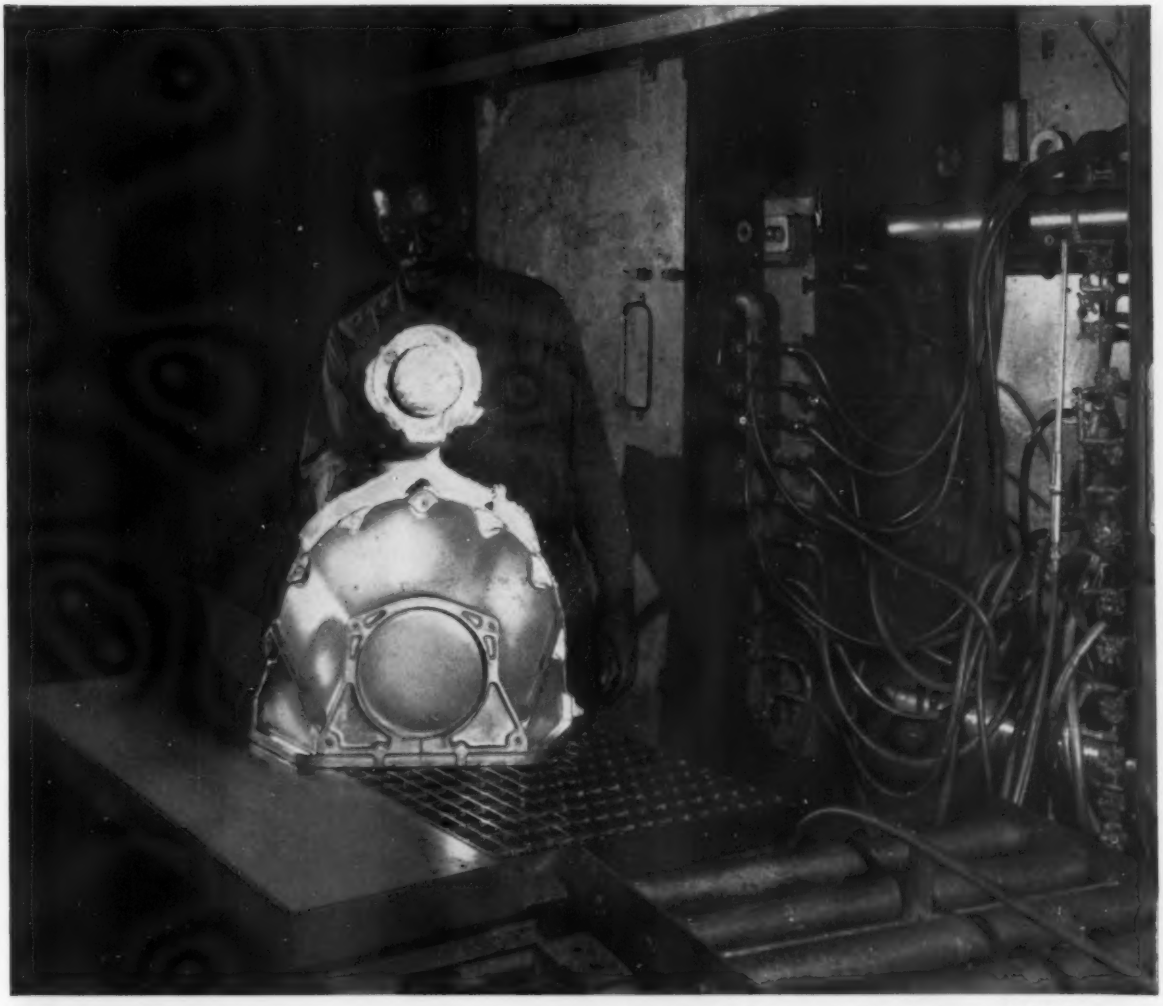
Only with the use of consistently perfect raw material can you be assured of a consistently perfect product and minimum scrap loss. Aluminum Smelting helps you maintain that assurance. In fact, each melt produced by Aluminum Smelting bears a certified analysis — your protection of quality.

QUICK, DEPENDABLE DELIVERY — ALL SHIPMENTS PALLETIZED

ALUMINUM SMELTING AND REFINING CO., INC.

MAPLE HEIGHTS, OHIO — TELEPHONE CLEVELAND — MONTROSE 2-3100
DETROIT, MICHIGAN — P. O. BOX 4014 — TELEPHONE VERMONT 7-3350
INDIANAPOLIS, INDIANA — 3737 N. MERIDIAN — WALNUT 5-9259

Circle No. 5 on Reader Service Card



1000-ton Cast-Master at Chrysler's Die Casting Plant, Kokomo, Indiana, produces 21 lb. torque converter housings.

Automotive Trend:

EVERYTHING'S SMALLER BUT THE DIE CASTINGS

It's a significant balance. Die castings get bigger as economic considerations puts top priority on low cost die casting production. Complicated assemblies are unit cast in one operation. Parts are lighter, rust free, easier to machine, easier to produce, less costly.

Cast-Master die casting machines have met many of these new challenges in a line that fills every need from a few ounces to 85 lbs. From tiny carburetor part to engine block, Cast-Masters have the machine; machines with interchangeable injection ends for hot or cold chamber casting, positive mechanical mold clamping, fast hydraulic injection principles.

If you're ready for die casting, standardize on Cast-Masters. The machine you can count on for more profit, more dependable production. Want to test a new product mold? Write Cast-Master for details on their Lab Test Program.

H115

H-P-M DIVISION - KOEHRING COMPANY

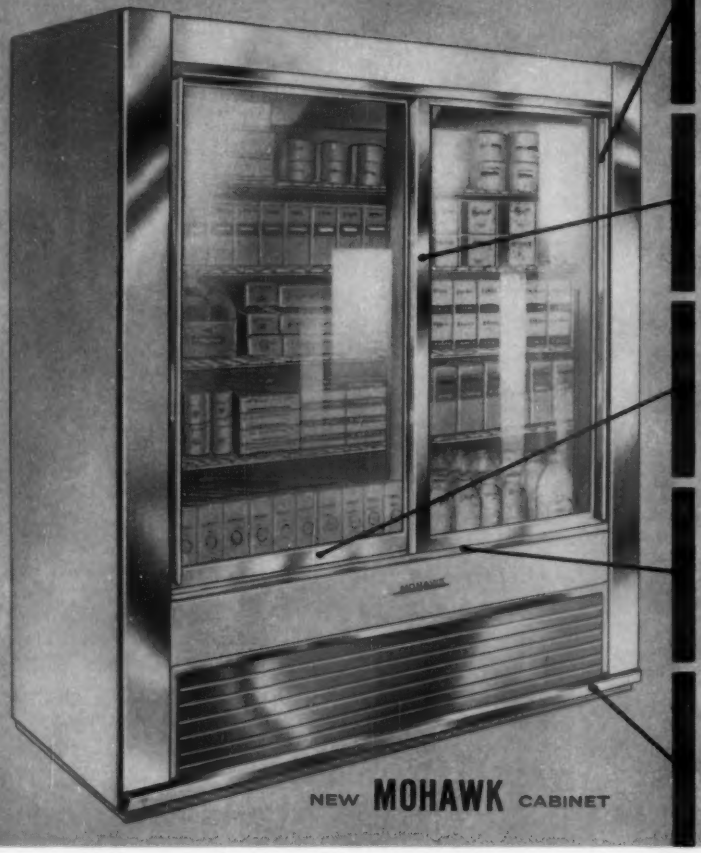
CAST-MASTER

23901 AURORA ROAD, BEDFORD, OHIO

Circle No. 28 on Reader Service Card

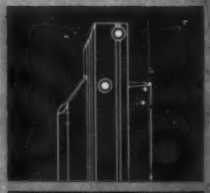
DESIGNING A NEW PRODUCT?

ask Superior about its money-saving aluminum extrusions



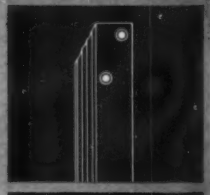
CABINET DOOR HANDLE

Extrusion includes rubber bumper adapter; mitered ends; drilled, countersunk, drilled and thread-tapped holes.



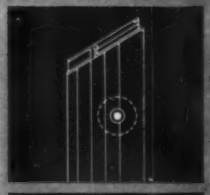
DOOR SLIDE RAIL

45° mitered, drilled, countersunk, polished, chemically brightened and anodized.



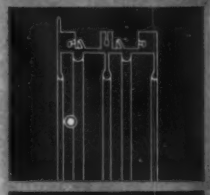
BOTTOM DOOR RAIL

(This section holds a nylon roller wheel.) Mitered, drilled, countersunk and precision thread tapped.



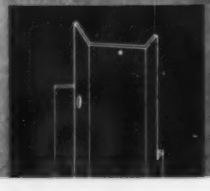
BOTTOM TRACK RAIL

Mitered, milled contours, drilled, countersunk, polished and anodized.



KICK RAIL

Notched, punched, polished, chemically brightened and anodized.



Let Superior show you how you can save money in many ways on your aluminum extrusions. The Mohawk cabinet above is an example of how this leading manufacturer gets extrusions perfectly fabricated from Superior Industries. The extrusions fit perfectly into Mohawk's production line without any further operation. Under one roof, Superior controls the fabricating and refinishing of all these parts, ready for assembly.

In addition to extruding intricate shapes, Superior miters, bends, rivets, drills, countersinks and notches the metal. Chemical and hand polishing, spray painting, anodizing and etching get professional attention. This entire performance saves you labor and factory time. And, thousands of companies have already taken advantage of Superior's complete services.

Send us samples, blueprints, or ask us to call. Superior engineers are now ready to help you to save in many ways.

ALUMINUM EXTRUDERS • ANODIZERS • ARTRIM MOULDINGS

SUPERIOR INDUSTRIES INC.

3788 Oakwood Ave.
Youngstown, Ohio

Circle No. 47 on Reader Service Card

PMM in this issue

March, 1961: Volume 19 Number 3

FEATURE ARTICLES

35 **WHY MAYTAG USES DIE CASTINGS AND SINTERINGS**

35 **The Maytag Policy**
An interview with George M. Umbreit, President.

36 **Design and development in laundry equipment**
An interview with T. R. Smith, Vice-president, Research & Development.

37 **Die Castings**
Many die cast parts are in current production.

39 **The role of production engineering**
An interview with W. A. Irvine, Manager, Production Engineering

41 **Purchasing practices and policies**
An interview with Wm. F. Langefeld, Director of Purchases.

42 **Permanent Mold Castings**
These are used in special cases.

43 **Powder metallurgy operations at Maytag**
An interview with Walter Anderson, Supervisor Quality Control, and Wesley Bissett, Plant Manager, Hampton Plant.

44 **Here is how Maytag makes sinterings**
Strict quality control is necessary.

46 **Organic finishing zinc and aluminum die casting**
An interview with P. J. Provin, Process Control Engineer, Organic Finishing.

48 **DIE CAST ARCHITECTURAL SCREEN**
Aluminum die castings resist the elements and offer low cost for a newly designed decorative wall.

50 **EXTRUDED MAGNESIUM PELLETS**
An authority discusses the current commercial product and experimental materials of extruded ZK 60 magnesium alloy pellets, and includes technical information about the alloys.

52 **LOW TOOLING COSTS FOR IMPACT EXTRUSIONS**
The story of impact extrusion production is shown in photographs.

53 **MOST MAGNESIUM ALLOYS CAN BE INVESTMENT CAST**
With perfection of many new production methods, the designer's choice is no longer limited to AZ29A for investment casting.

56 **HEAT TREATMENT OF CAST STAINLESS STEELS**
This report on the semi-austenitic stainless, AM-355, is part III, and the conclusion, of a series on heat treating stainless steels.

58 **PLASTIC CASTINGS FOR CHECKING DIE CASTINGS**
One tool and die maker has found a way for a producer to check dimensional accuracy of his die while the tools are still in the shop.

80 **INVESTMENT CAST MICRO-SWITCH**
Maximum corrosion resistance plus cost savings are gained by switching from a machined part to investment casting.

80 **SMALL DIE CASTINGS FOR RECORD PLAYERS**
Automatic die casting small parts in zinc eliminates many secondary machining operations.

FINISHING SECTION

63 **HOW TO POLISH LONG EXTRUSIONS—AUTOMATICALLY**
Long aluminum extruded door styles, that must have highly buffed surfaces, are polished with automatic buffing machines.

DEPARTMENTS

10 Casting About
14 Letters
21 Industry News
27 New Products
73 Data in Ads
75 Useful Literature
89 Books
91 Opportunities

DISTILLED WRITING

Published monthly, copyright 1961 by
THE INDUSTRIAL PUBLISHING CORP.

To make the BEST...
Begin with the
BEST CASTINGS!

Latrobe
Die
Casting Co.

Aluminum Alloy Castings

Zinc Alloy Castings

Tin and Lead Alloy Castings

DISTRICT OFFICES

AKRON, OHIO
E. G. Siess, Jr.
227 W. Exchange St.
Tel: Portage 2-7663

BUFFALO, N. Y.
Harry W. Harding
235 Burke Drive
Tel: Amhurst 1164

CLEVELAND, OHIO
William Kranz
20001 West Lake Road
Tel: Edison 1-6888

DAYTON, OHIO
J. M. Gallaher
363 West First St.
Tel: Baldwin 4-3523

DETROIT, MICHIGAN
J. R. Lemen, Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thomson
741 Glenbrook Rd.
Stamford, Conn.
Tel: Fireside 8-3985

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Latrobe
Die
Casting Co.
Latrobe, Pennsylvania

Established 1918

Circle No. 32 on Reader Service Card

Precision Metal Molding

STAFF

David W. Veit ..... *publishing director*
Philip R. Kalischer ..... *editor*
Ronald Khol ..... *associate editor*
Robert K. Mueller ..... *assistant editor*
Scholer Bangs ..... *western editor*
672 So. Lafayette Park Pl.
Los Angeles 57, California
Henry Lefer ..... *eastern editor*
Rm. 835, 60 E. 42 St.
New York 17, N. Y.
H. K. Barton ..... *foreign editor*
Hiram Barton Associates
Roughfield, Etchingham
Sussex, England
Alaric Mausser ..... *art director*
N. G. Kiser ..... *circulation manager*
Robert Gauvin *mgr. reader service dept.*
Mary A. Cindrich ... *editorial assistant*

SALES OFFICES

Cleveland 15
812 Huron Rd., SU 1-9620
ROBERT SIMMONS

New York City 17
Rm. 835, 60 E. 42 St., MU 7-3420
LEE HAAS, *manager*
ARTHUR L. GOEBEL

Chicago 11
Rm. 704, 520 N. Michigan,
WH 3-1655
CHARLES F. GEYER, *manager*
KENNETH L. JONES

Los Angeles 57
672 S. Lafayette Park Pl.,
DU 7-5104
ALAN T. CAZIER, *manager*
LLOYD BROOKMYER

London, S.W. 1, England
36 Victoria Street,
Sullivan 6072
JOHN A. LANKESTER, *manager*

SUBSCRIPTIONS in U.S. and possessions: $7. 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £ 3.5.0 per year payable in Sterling to London office. Single copies, when available: 1 to 10 — 75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

Out of print copies of PRECISION METAL MOLDING are available in complete volumes as positive microfilm copies from University Microfilms, 313 N. First St., Ann Arbor, Mich.

Editorial and executive offices: 812 Huron Rd., Cleveland 15, O.

LESTER P. AURBACH ..... *president*
EDWIN M. JOSEPH .... *executive v. p.*
PAUL ROLNICK ..... *vice president*
N. N. GOODMAN, JR. ... *vice president*
LEE HAAS ..... *vice president*
CHARLES F. GEYER .... *vice president*
THOMAS L. DEMPSEY .. *asst. sect.-treas.*

AFFILIATED PUBLICATIONS: Hydraulics & Pneumatics, The Refrigeration & Air-conditioning Business, Material Handling Engineering, Handling & Shipping, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication. Member BPA.

Accepted as a controlled circulation publication at St. Joseph, Michigan. Not responsible for unsolicited editorial material. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio. Printed in the U.S.A.

ASARCO ZINC DIE CAST ALLOYS

For Trouble-Free Die Casting

Specify Asarco Zinc Alloy

When the job calls for zinc die castings to meet high standards of product quality, use Asarco zinc die cast metal. It is made from Special High Grade Zinc, 99.99+% pure, the world's purest metal produced in large tonnages. Its purity and uniformity, unsurpassed anywhere, are assured by Asarco-developed electrolytic refining processes and by completely controlled alloying techniques. Asarco Zinc Die Cast Alloys numbers 3, 5 and 7, sold by the Federated Metals Division, are ready for immediate shipment from stock in seven convenient supply centers across the country. With Asarco Zinc die casting alloys you get low material cost, superior impact strength and castability, minimum machining and finishing time, reduced production time and cost, shorter casting time, low temperature casting, smoothest casting surfaces, brilliant and lasting finishes.

For complete information, write or call Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N.Y., or your nearest Federated sales office.

ASARCO

Circle No. 6 on Reader Service Card

MISCO

CAPABILITY
RELIABILITY
REPRODUCIBILITY
proven

TEN MILLION TIMES!

Misco has produced 10,000,000 investment cast blades and vanes in support of gas turbine propulsive power in the MAJOR ENGINES of today's world – for AIRCRAFT, LAND vehicles, RAILROADS, and MARINE applications.

These blades and vanes have been produced for 100 CUSTOMERS, involving 67 DIFFERENT ENGINE APPLICATIONS and 1,000 DIFFERENT DESIGNS, processed with 40 DIFFERENT ALLOYS.

Misco processes meet the requirements of a variety of applications.

Whether you require hollow or solid components—produced under air, argon or vacuum-melt atmospheres – *whatever the shape or complexity* – you can place your CONFIDENCE in Misco.

How are YOU fixed for blades?

Send us your inquiries, details of your requirements, or parts for quotation.

Misco Precision Casting Company

DIVISION OF HOWE SOUND COMPANY

Plants in
WHITEHALL, MICHIGAN
MUSKEGON, MICHIGAN

MISCO

Address inquiries to
122 Gibbs Street
WHITEHALL, MICHIGAN
TWinoaks 3-1515

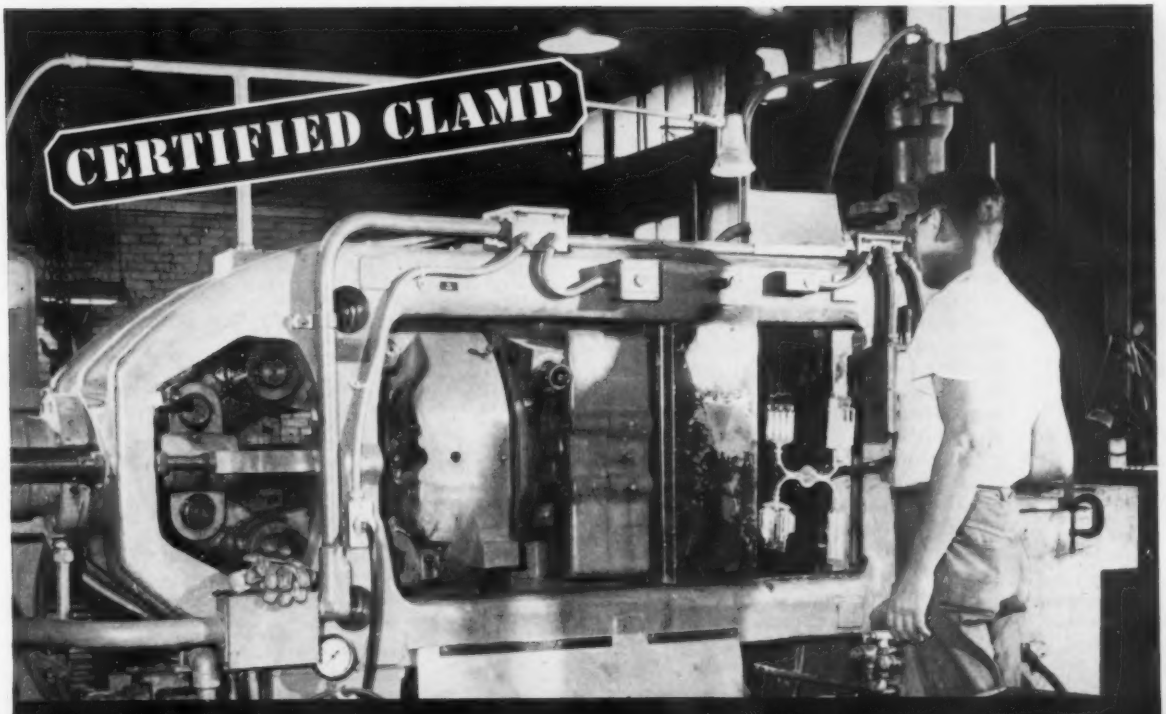
MONO-SHELL

Sales Offices in Principal Cities

PRODUCERS OF AIRCRAFT AND INDUSTRIAL INVESTMENT CASTINGS

Circle No. 38 on Reader Service Card

V-M



Fine Zinc Castings require **CERTIFIED CLAMP**... consider what **A LESTER DIE CASTING MACHINE** does for Sunnen Products...

The zinc alloy die castings produced at Sunnen Products Company of St. Louis, Mo., are incorporated into their ultra-precision industrial honing equipment—and the tolerances for the castings are as exacting as the work the Sunnen products do. Casting specifications also demand good finish, free of porosity and surface flaking.

To achieve this at Sunnen they can use the full fluidity of the metal—to make maximum use of the property potentials of the metal—because the HP-2½-SF Lester which they use has a full 400 tons of CERTIFIED clamp. It will hold any of their dies—from long vertical dies and large gage housing dies to four-unit interchangeable dies for highly detailed and intricate small parts —and where close functional casting dimensions are required, hold them all with a maximum ± .001" die closing tolerance.

If you need quality die casting over the broadest range of work, Lester can perform for you, too. Write for illustrated Bulletin 102.

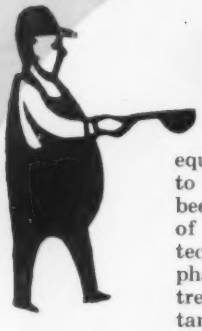
LESTER-PHOENIX, INC

2708-F CHURCH AVENUE • CLEVELAND 13, OHIO

Agents in principal cities throughout the world

Circle No. 81 on Reader Service Card

Wherever aluminum needs heat



Meet "Little Joe"! He looks something like a fellow in our plant but we really use him as a symbol of the good right hand of service Lindberg-Fisher's expert design staff and our complete line of "heat for aluminum" equipment is able to render you.

LINDBERG FISHER

You'll find this nameplate on all the equipment you'll need for applying heat to aluminum. Heat and aluminum have been Lindberg's babies for years. Our staff of expert engineers, metallurgists and technicians is widely experienced in all phases of aluminum melting, casting, and treating and has pioneered many important developments in aluminum processing by heat. Today, Lindberg offers you a complete line of heating equipment for every requirement in this field. This includes every needed type of melting, holding or heat treating furnace, large and small, shop built or field erected, fuel fired or electric (resistance, 60 cycle induction, arc or high frequency). We hope you'll let our symbolic friend, "Little Joe", guide you through the exposition of this equipment offered on these pages.

Hot Metal Delivery

MELTING

"RIGHT FROM THE START, LINDBERG EQUIPMENT TAKES OVER YOUR ALUMINUM HEATING NEEDS."

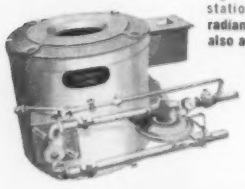
Fuel fired reverberatory. Charging well optional.

"MOLTEN METAL FROM REDUCTION CELLS IS HELD, OR INGOTS MELTED, IN FURNACES LIKE THESE"

CASTING STATION

Fuel fired reverberatory, holding or melting.

"MOLTEN METAL IS HELD AT THE CORRECT TEMPERATURE UNTIL PROCESSED INTO CASTINGS."



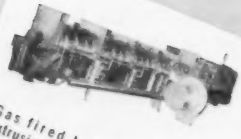
Fuel fired crucible or pot, holding or melting, stationary. **New radiant wall type also available.**

"MANY CASTING STATION FURNACES CAN BE EQUIPPED WITH THE LINDBERG AUTOLADLE, NAMED 'LITTLE JOE', AFTER ME."

Autoladle for automatic ladling, four shot sizes available, up to 100 lbs.

HYNI nitrogen generator, for atmosphere melting and fluxing.

SPECIAL EQUIPMENT



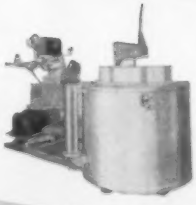
Gas fired billet heater for extrusions.

"SOME CASTINGS MAY REQUIRE HEAT TREATMENT AND THESE ARE HANDLED IN THE FURNACES BELOW."

"SO, DOWN TO THE FINISHED PRODUCT, LINDBERG EQUIPMENT TAKES CARE OF EVERY STEP."

HEAT

Cyclone heat treating, electric or fuel fired, box or pit.



Cyclone heat treating, electric or fuel fired, box or pit.

60 cycle induction billet heater for extrusions.

BILLETS RODS CASTINGS

LINDBERG equipment will apply it

Key
Molten Metal
Solid Metal

Ingot

AND HOLDING FURNACES

60 cycle two chamber induction, tilting.

Fuel fired double reverberatory. Especially suitable for alloying. Charging well optional.

60 cycle, two chamber induction, tilting; melting and holding.

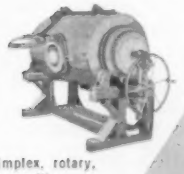
MELTING, HOLDING AND REMELT FURNACES

60 cycle induction coreless, tilting, ideal for melting chips.

Fuel fired, crucible or pot, tilting, melting.

Electric resistance, "radiant muffle," Dry-Hearth, melting and holding, nitrogen atmosphere.

High frequency induction, tilting, melting.

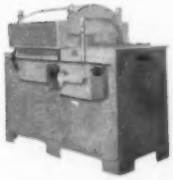


Fuel fired, Simplex, rotary, horizontal drum, melting.

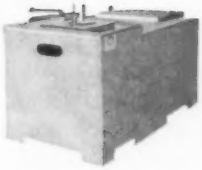
"AS REQUIRED, MOLTEN METAL IS TRANSFERRED TO FURNACES AT THE CASTING STATIONS."

"INGOTS CAN ALSO BE MELTED AND HELD IN THESE FURNACES."

FURNACES



Electric resistance, "radiant dome," reverberatory, holding.



60 cycle, two chamber induction, holding or melting, stationary.

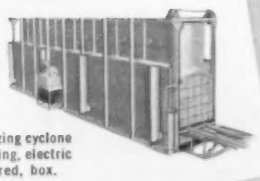
Electric resistance, crucible or pot, holding or melting, stationary.

Fuel fired, Dry-Hearth, two chamber, holding or melting.

"GATES, RISERS, SCRAP CASTINGS, ETC. GO BACK TO THE FURNACES AT THE RIGHT FOR REMELTING."

"WHY NOT GET IN TOUCH WITH LINDBERG FOR YOUR ALUMINUM HEATING NEEDS? TELL THEM 'LITTLE JOE' SENT YOU."

TREATING FURNACES



Homogenizing cyclone heat treating, electric or fuel fired, box.

D. C. INGOTS

Circle No. 76 on Reader Service Card

We'll be glad to discuss your aluminum processing needs with you. Get in touch with your local Lindberg Representative (see your classified phone book) or write us direct.

LINDBERG FISHER DIVISION

LINDBERG ENGINEERING COMPANY

2463 West Hubbard Street, Chicago 12, Illinois

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland, and West Germany.

PMM

casting about *technical news of applications & processes involving precision metal molding*

New Process May Expand Usefulness of Tungsten

The Dynapak high-velocity extruding process promises to expand the usefulness of tungsten as a structural material. Tests conducted at the Convair Division of General Dynamics Corporation have shown that if tungsten is formed fast enough, extensive grain refinement occurs. In turn, this produces a striking improvement in the ductility and toughness of the metal.

In addition, the high-velocity extrusion technique can produce area reductions much greater than those obtained with orthodox extrusion equipment. In tests conducted by the National Aeronautics and Space Administration, an 8:1 reduction was the best that could be obtained on a standard extrusion press moving at about 150 inches per minute. In order to obtain even this low level of reduction a columbium jacket and glass and graphite lubricant had to be used.

By contrast, reductions of 45:1 were obtained with the high-velocity extruding technique.

Even more important from the structural engineer's point of view is the effect of the process on grain structure. Tungsten billets are usually formed by powdered metallurgy techniques or by arc-melting in a controlled atmosphere. In either case a large grain structure is likely to result. This produces brittle lines of weakness along the grain boundaries where impurities accumulate.

Low-velocity extruding simply flattens out large grains and produces no reduction in average crystal size. High-velocity extruding, however, reforms tungsten into much smaller crystals (For another grain refining technique on tungsten, see PMM, Sept. '60, pg. 10).

Large Structural Extrusions Used in Railroad Car

This is the largest aluminum railroad car ever built according to Harvey Aluminum. Designed to provide protective shipment for long loads, it demonstrates the application of large structural aluminum extrusions to achieve improved performance and lower fabricating and operating costs.

The car is an experimental unit of the covered gondola type and is 85 feet long. The dominant structural feature of the car is six huge extrusions 82 feet long and 25 inches wide. They are stacked on top of each other, three on a side, to form the sides.

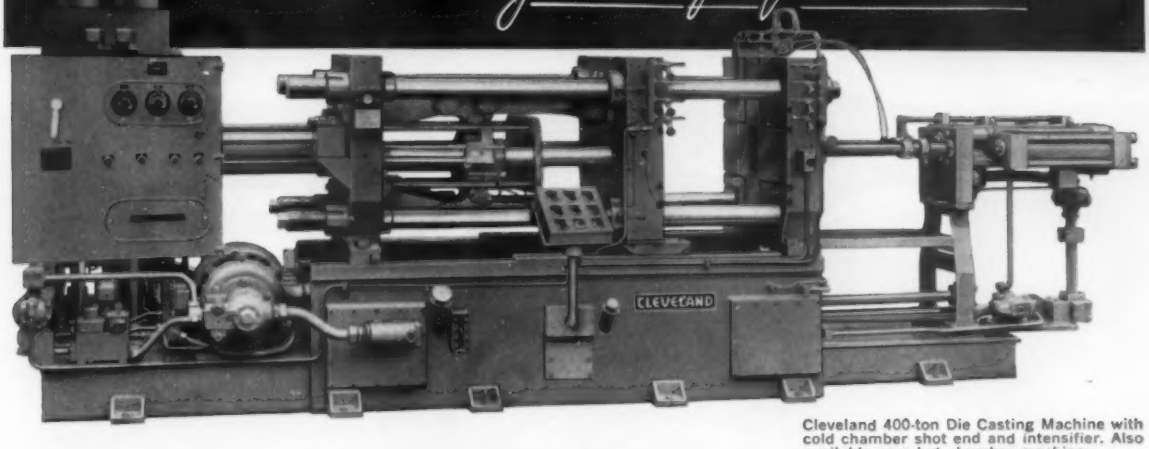
Panel type extrusions make up four 20-foot sections for the roof. These are removable for freight handling.

The completed car weighs 37½ tons, but the weight of the aluminum superstructure is under 5 tons. A comparable car in steel would weigh 8 tons more. The load limit for the new car is 67 tons and the capacity is 3,240 cubic feet.

The general design concept for the car was developed by Harvey's product development staff in cooperation with North American Car Corporation and the Rock Island Lines. The car is currently under lease to the Rock Island from North American and has recently completed a coast-to-coast test run.

NEW FEATURES*

mean even greater performance...

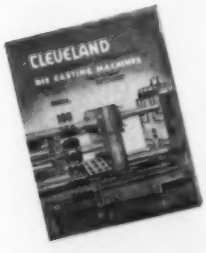


Cleveland 400-ton Die Casting Machine with cold chamber shot end and intensifier. Also available as a hot chamber machine.

from the CLEVELAND Model 400 DIE CASTING MACHINE

For its exceptionally fine performance with low maintenance, the Model 400 Cleveland is one of the die casting industry's most popular medium size machines. Now, new design refinements have been incorporated — see partial listing of features at right — which even further improve its performance, making the Model 400 Cleveland the outstanding machine in its class. Also attractively priced!

If your needs call for machines of other capacities, you'll find the entire Cleveland line to be as up to the minute in design and quality of construction as is the Model 400. Cleveland also builds 100, 250, 650, 850, 1000 and 2000 ton machines. And Cleveland is a leader in machine automation and vacuum die casting, should these optional features be among your production requirements. For detailed information, write direct, or call in a Cleveland sales engineer.



New general catalog describes the full line of Cleveland Die Casting Machines. Write for your copy.

Model 400 Specifications:

Size of die plates (ver.& hor.)	*40½" x 40"*
Space between tie bars	*20" x 24"*
Die Thickness (max. & min.)	*32"—12"*
Die opening (adjust.)	*6" to 12"*

* NEW DESIGN FEATURES INCLUDE:

- Locking pressure 400+ tons, strain gage tested by S.D.C.E. method.
- Virtually leak-proof hydraulic system built to J.I.C. standards. Manifold piping, using steel tubing and fittings. Lines 1" and over are welded.
- 20 hp. T.E.F.C. motor drives two Vickers pumps. 2000 lb. pump pressure for final squeeze to the shot.
- Externally mounted Rosaen filters on suction side of pump indicate when cleaning is necessary.
- "O" ring used in die closing cylinder. Return stroke has improved cushion. Handwheel on cylinder adjusts length of die stroke, indicated by calibrated scale.
- New design cold chamber shot end; 4" dia. shot cylinder; stroke adjustable from 14" to 18". Shot intensifier available.
- New design hot chamber shot end permits quick gooseneck adjustment and removal. 4" dia. shot cylinder; 7" stroke. Telescopic tubes eliminate swivel fittings.
- Two-position shot injection adjustment on hot and cold chamber machines.
- Massive toggle linkage in horizontal plane provides maximum accessibility for locating ejector pins. S.D.C.E. recommended pattern for ejector pin holes and platen T-slots.
- Movable platen supported by rollers riding on hardened steel plates.
- Modern electric control panel and convenient operator pushbutton station. Machine operating sequences programmed by templates. Electrics designed to J.I.C. standards.

Sales Offices: Chicago • Cleveland • Detroit • Hartford • Springfield, N.J.

CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street • Cincinnati 12, Ohio

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

Circle No. 16 on Reader Service Card

HIGH GRADE • INTERMEDIATE • BRASS SPECIAL

Now!

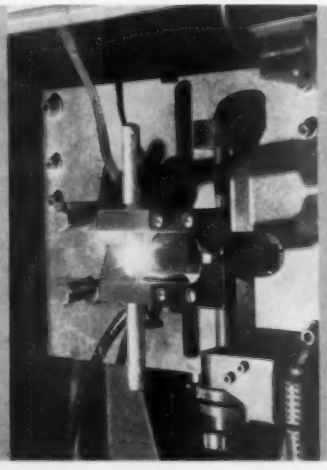
ST. JOE

▶ **New Member Of The Famous Line of St. Joe Metals**

▶ **Developed By *Research*—**

Guarded By Stringent *Quality Control*

Sample To Complete Analysis in 10 Minutes



To maintain St. Joe zinc's unmatched purity on a continuous basis, an operator casts samples (shown 1/5 actual size) and sends them via air tube to the Baird-Atomic Direct Reading Spectrometer. There a technician places the samples in the Spectrometer's electrode holders. Extremely high voltage creates an arc across the electrodes. As elements are vaporized, light from the arc is broken into element lines of varying light energy.

. . . And This Is How It's Done

This energy, directed to photomultipliers (photo-sensitive electronic tubes), is converted to electrical energy which actuates pre-calibrated dials that indicate elements directly IN PERCENTAGES! In five minutes the zinc sample can be completely analyzed for iron, lead, cadmium, copper, aluminum, indium, tin, antimony, silicon and magnesium. Two minutes later by return tube casting room operators know whether or not they are holding critical purity specifications.

• PRIME WESTERN • "TAILOR-MADE" GRADES

ZINC

99.99+%

St. Joe's modern research laboratories developed the process — St. Joe's rigid, scientific quality control maintains consistent guard over the product — St. Joe 99.99+% Zinc.

Every shipment of St. Joe 99.99+% Zinc is backed by St. Joe's reputation of nearly a century as a supplier of quality metal to American Industry. Consistent metal from St. Joe means consistent results in die-casting.

ST. JOSEPH LEAD COMPANY

ST. JOE

250 PARK AVENUE NEW YORK 17, N. Y.

THE
FREEDOM
DI
MEN
SION

. . . stretches your design potential

Parts-design becomes as flexible as wax when you specify investment casting. With the "lost wax" process, parts may be designed for function...operating efficiency . . . and wearability. Costly machining and assembly operations are reduced and often eliminated. A wide variety of alloys offers better parts performance and cost reductions.

To discover the benefits Hitchiner Investment Casting can bring you...

write for complete technical and facilities information.

HITCHINER
Milford 4, New Hampshire
Circle No. 24 on Reader Service Card

PMM letters

the readers' forum

TRADEMARK ERROR

In the Fifth Annual Die Casting Directory and Buyers Guide in your January issue there is an error in the trademark listings. The emblems of the Hamilton Die Casting Corporation and the Hamilton Die Cast Inc. have been transposed. We realize that these things happen, but would appreciate you correcting your records.—T.F. Woltering, Hamilton Die Cast Inc.

Hamilton Die Cast Co.
240 N. "B" St.
Hamilton, Ohio
Metals: A, B
Services: M, F, A.

Hamilton Die Casting Corp.*
2020 Jericho Turnpike
New Hyde Park, N.Y.
Metals: A, B
Services: M, A
*ADCI member

Thanks, we are sorry for the mix-up. To set the record straight, above are the listings as they should have appeared. —Ed.

"KXA" STEEL

We are making some modifications on various parts of our die casting equipment and would like to use a steel designated as "KXA". This "KXA" is used by many for plungers and gooseneck sleeves.—P.H.

The material "KXA" is a product of the Rex Buckeye Company. We suggest you address any communications regarding this steel to Mr. L. E. Pearch, The Rex Buckeye Company, 2019 West 41 Street, Cleveland, Ohio.—Ed.

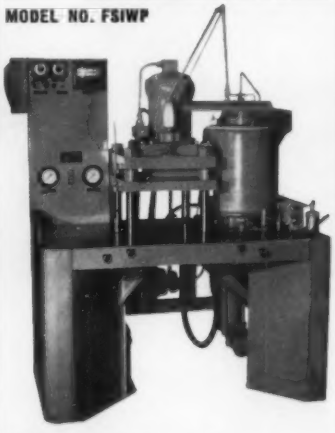
VIBRATORY FINISHING

Could you please send me more data on vibratory finishing, and the name of a nearby vendor.—W.R., Chief Engineer.

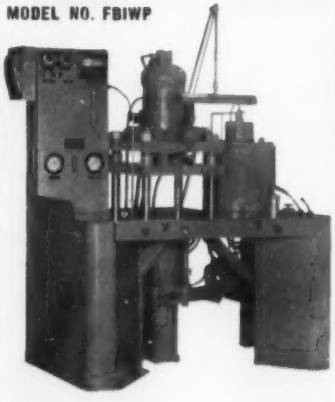
More information about vibratory finishing can be secured in your area from Metal Finish, Incorporated, 410 Frelinghuysen Ave., Newark, New Jersey.—Ed.

NEW
3½ lbs. WAX CAPACITY
ON STANDARD MODEL
#FSIWP

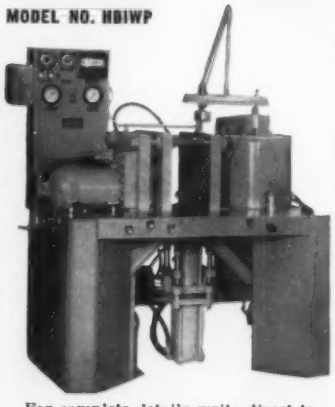
MODEL NO. FSIWP



MODEL NO. FBIWP



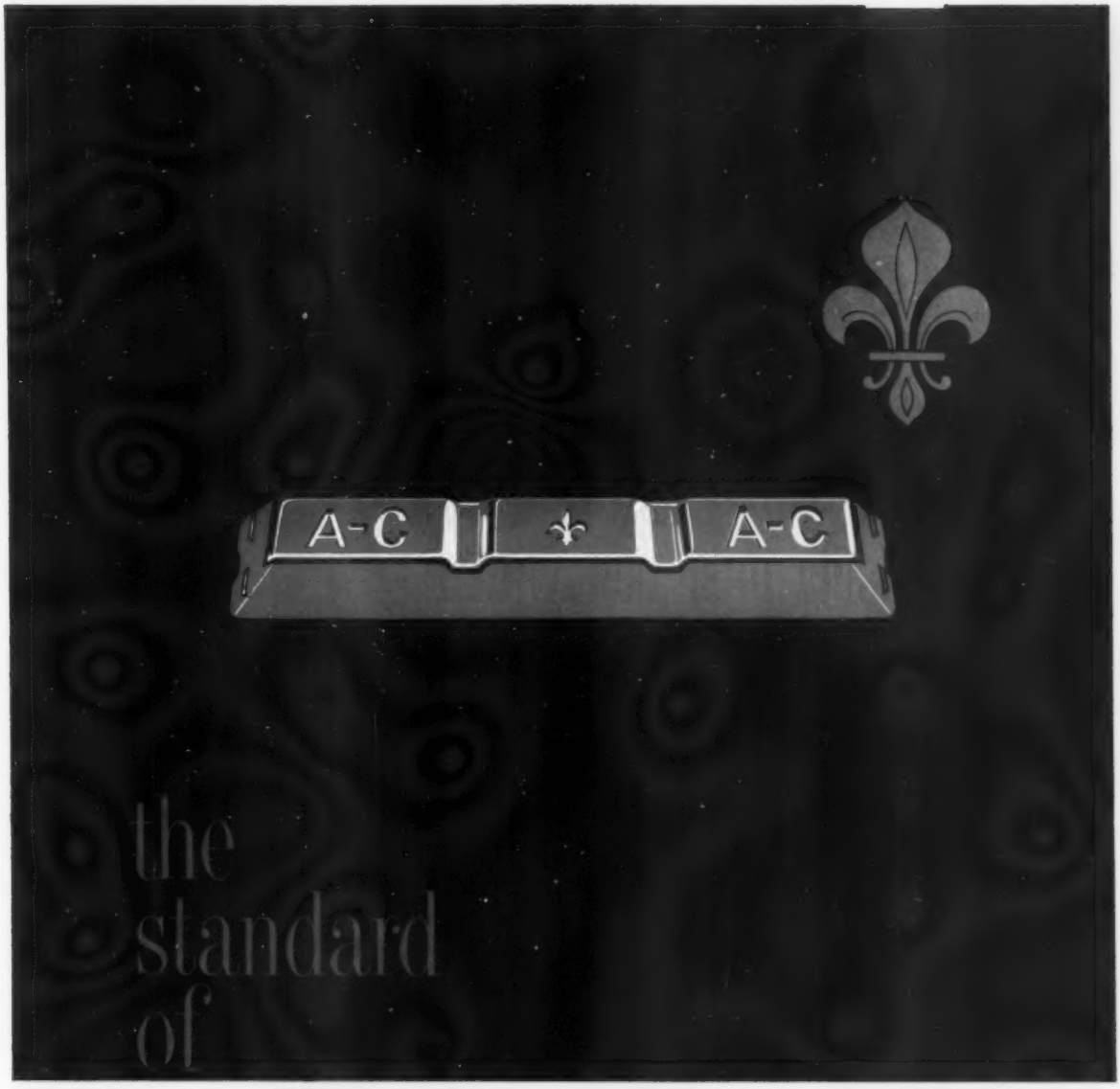
MODEL NO. HBIWP



For complete details write direct to Leyden Hydraulics

Any Type or Size Unit Built to Your Specifications.

LEYDEN HYDRAULICS, INC.
1800 North River Rd. • Melrose Park, Ill.



excellence everywhere

the fleur de lis — AE your guarantee of quality. Quality AC alloys insure the utmost in uniform chemical composition and physical characteristics. In fact, we're so proud of our product – we ship it to you packaged in polyethylene. ■ AC maintains a complete warehouse inventory located in the heart of industrial America – to provide immediate dependable delivery when you want it – where you need it. ■ These are just a few of the reasons why Alloys and Chemicals Corporation is the fastest growing aluminum smelter in the country.

Our sales engineers and technical staff are available for consultation.

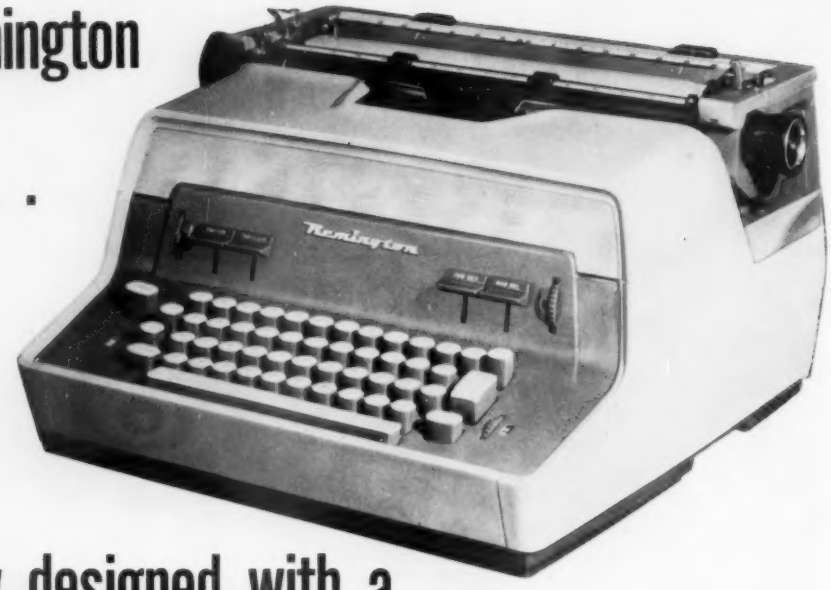
ALLOYS and CHEMICALS CORP.

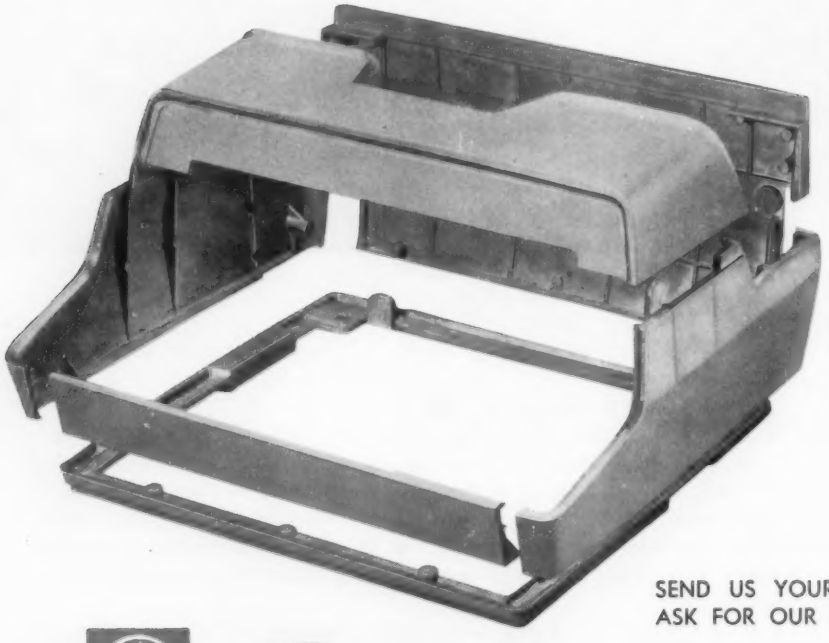
Aluminum Alloys

4365 BRADLEY ROAD S.W. • CLEVELAND 9, OHIO • ONTARIO 1-8600

Circle No. 88 on Reader Service Card

The new Remington Electric is . . . stronger, lighter, more stylishly designed with a *Premier* aluminum die cast housing





DESIGNED FOR DIE CASTING AT PREMIER where quality zinc and aluminum die castings are made. Let Premier solve your design and production problems on *any* business machine.

- VACUUM CASTING
- AUTOMATIC LADLING

for

Thinner Wall Sections
Minimum Porosity
Constant Quality
Improved Surfaces

SEND US YOUR PRINT FOR QUOTATIONS.
ASK FOR OUR FREE FACILITIES BROCHURE.

Premier **DIE CASTING COMPANY**

24 MARGARETTA STREET • NEWARK 5, NEW JERSEY

Circle No. 42 on Reader Service Card

PRECISION METAL MOLDING

My answer for fire-resistant fluids is... UCON Hydrolubes

Q. WHAT FLUID GIVES YOU EASY CONVERSION, GOOD PROTECTION, AND LOW LOSS?

Most hydraulic systems can be quickly and easily converted to fire-resistant UCON hydrolubes. Actual experience, in hundreds of industrial installations, shows that standard flushing and refilling procedures, involving a minimum of time and effort are sufficient.

The procedure generally followed in converting to a UCON hydrolube fluid from petroleum fluids is:

- Drain oil; remove sludge, deposits, and reservoir paint if affected by UCON hydrolubes.
- Flush with UCON hydrolube.
- Install a clean filter and replace worn parts. Repair leaking pipe joints.
- Operate at reduced pressure to insure proper lubrication of the hydraulic pump; then bring the system up to standard operating conditions.

No special packings and seals are required.

The same procedure is followed in replacing non-aqueous, fire-resistant fluids with UCON hydrolubes. But, all the old fluid must be first removed by flushing with petroleum hydraulic oil.

And, once installed, UCON hydrolubes have low loss.

UCON hydrolubes are the economical answer for fire-resistance in hydraulic fluids. Extensive field tests and more than 10 years of routine use in industrial hydraulic equipment prove this. UCON hydrolubes are approved for use by Factory Mutual Laboratories.

Get all the facts on UCON hydrolubes. Read the booklet, "UCON Hydrolubes Spell Safety." For your copy, ask a CARBIDE Technical Representative or write Union Carbide Chemicals Company, Division of Union Carbide Corporation, Department J3, 270 Park Avenue, New York 17, N.Y.

UNION CARBIDE and UCON are registered trade marks.

UNION CARBIDE CHEMICALS COMPANY

UNION CARBIDE

Circle No. 85 on Reader Service Card

TRIULZI

Novate (Milano)
Italy
Via Vialba. 56
Telephone 3 49 16 61/2/3/4
3 49 17 85/6/7/8
Telegraph TRIULZIPRES
NOVATE
MILANESE

brings your attention to its latest achievement

castmatic 2500

the largest in the world!

DIE CASTING MACHINES

oil operated — automatic — fast cycling

COLD CHAMBER

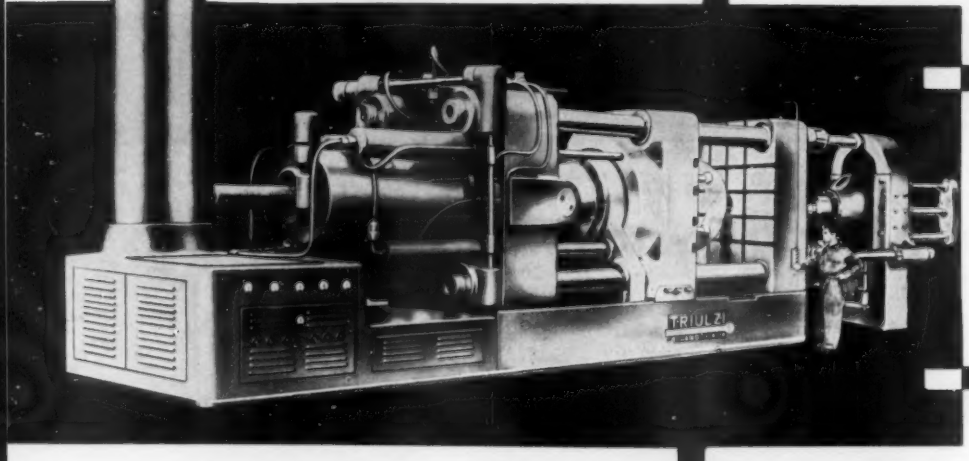
vertical and horizontal injection

and

HOT CHAMBER

from 35 to 2500 U.S. Tons

VISIT US AT THE STUTTGART FAIR, March 7-17, 1961
VISIT US AT THE MILAN FAIR, April 12-27, 1961
Pavilion 17, Stands 17411, 17469, 17471 and Hall C (outside of Pavilion 17).



cold chamber CASTMATIC 2500
2500 U.S. tons LOCKING FORCE
positive clamping system by blocked piston
weight of the casting (Al. base) up to 130 lbs.

ALL CASTMATIC MACHINES are normally fitted with:

- VICKERS hydraulics
- SIEMENS electrics
- automatic cycle equipment, with PROGRAMME PRE-SELECTING PANEL

and can also be equipped with:

- DOSOMATIC: automatic dosing-filling furnace for cold chamber machines
- VACUUM DIE CASTING device
- AUTOMATIC FORCED LUBRICATION of all mechanical parts
- OVERSIZE WATER HYDRAULIC PLANT for fast cycling
- DEVICE for the automatic control of the oil temperature
- TRIM press, oil operated, fast cycling — for trimming burrs and sprues

Circle No. 49 on Reader Service Card

OUR STANDARD PRODUCTION:

- deep-drawing presses
- Arbor presses—Extruding presses
- Coining, gauging, hobbing presses
- HIGH PRESSURE HYDRAULIC PUMPS
- INJECTION MOULDING MACHINES FOR PLASTICS
  Models with preplasticizer: from 3 to 705 oz.
  without preplasticizer: from 3/4 to 28 oz.
- VERTICAL PRESSES FOR THERMOSETTING MATERIALS
- THERMOFORMING MACHINES FOR THERMO-PLASTIC LAMINATES
- BLOW MOULDING MACHINES FOR PLASTIC HOLLOW ITEMS
- SCREWS AND COMPLETE EXTRUDING PLANTS for making films, rigid and flexible profiles, hollow coatings, plastics coloring and granulation
- PRESSES for POLYESTERS and for PLASTIC LAMINATES
- RECORD MOULDING PRESSES
- SPECIAL PLANTS FOR PROCESSING PLASTICS

Make ALAN WOOD your IRON POWDER HEADQUARTERS

Dependable Uniformity, Delivery, Service

A. W. Iron Powder can be your key to new design flexibility, reduced production costs and products of superior quality with closer tolerances. A.W. Iron Powder assures you of high purity, uniformity of size and composition . . . plus outstanding fabrication properties. Custom-mixed blends are readily produced to meet your most exacting specifications.

You're assured of prompt deliveries with A.W. Iron Powder, now being manufactured in volume in our 50-ton-a-day direct reduction plant. Behind these modern facilities are years of pilot plant operation, thorough testing and proving in customer applications.

And you're assured, too, of continuing quality and competent service. A.W. Iron Powder is backed by the full resources of Alan Wood Steel Company . . . extensive laboratory and research facilities . . . application engineering . . . and Customer Advisory Service to help make your investment more productive. Send today for technical data and application information . . . fill in the coupon below for samples and details.

ALAN WOOD STEEL COMPANY
CONSHOHOCKEN, PA.

FOR MORE INFORMATION

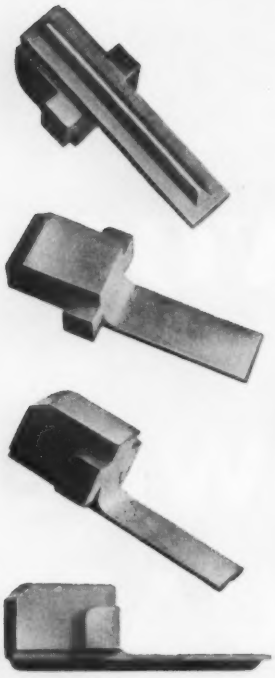
Manager
Iron Powder Sales
Alan Wood Steel Company
Conshohocken, Pa.

I am interested in Iron Powder for:
☐ Molding ☐ Friction ☐ Other
☐ Send literature ☐ Send sample

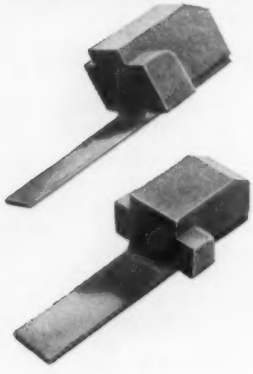
NAME_____
TITLE_____
COMPANY_____
ADDRESS_____ CITY_____ STATE_____

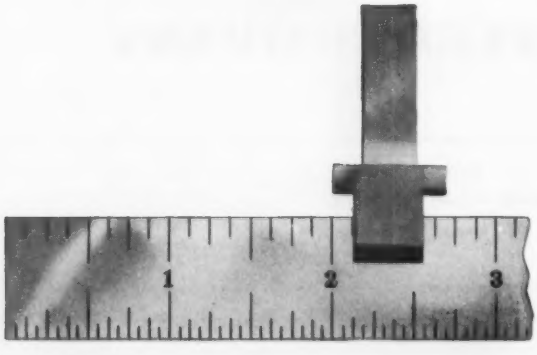
AMERICAN STEELMASTERS FOR 135 YEARS

Circle No. 2 on Reader Service Card



You save from every angle with V-R investment castings





Save machining time — V-R Investment Castings eliminate intricate machining operations on small, complex parts. Irregular shapes and fine detail on all surfaces are accurately and economically reproduced.

Save design time — V-R Investment Castings let you design for function without compromise for machining limitations. Multiple parts are often cast as single units. Uniform, close tolerances are held throughout the entire production quantity.

Save specifying time — V-R Investment Castings allow you to specify metals that are difficult, or even impossible, to machine. Thus, exceptional resistance to wear, heat and corrosion can be cast right into the part. Tantung, steel, beryllium copper, stainless steel or other special alloys are available to meet your requirements. Learn how you can save from every angle with V-R Investment Castings. Send sample or drawing, with specifications, today.

CREATING THE METALS THAT SHAPE THE FUTURE

VASCOLOY-RAMET

858 MARKET STREET • WAUKEGAN, ILLINOIS

I-817

Circle No. 52 on Reader Service Card

PMM

news of industry & associations *activities of people, companies & groups in the precision metal molding industries*

PROMOTIONS AND CHANGES

Hydraulic Press Mfg. Co.—Cast-Master Division—*J. W. Palmer* has been promoted to general manager and *R. D. Critzer* to sales manager.

Crucible Steel Co.—*W. B. Downes* has been appointed to a newly created post to handle executive customer relations for the stainless steel division.

Hitchiner Mfg. Co.—*Harry A. Porter* is now serving in the metallurgical department assisting sales, estimating and the production engineers.

The Permold Co.—*J. J. Kroeckler* assumes duties as sales manager, and *L. E. DeGroat* is now vice president and director.

Foundry Services, Inc.—*John E. Gotheridge* has been appointed eastern regional sales manager. *Jack Morgan* has been named technical service manager.

Doehler-Jarvis Division of National Lead Co.—*August D. Gildmeister* and *William G. Knuff* have been named assistant sales managers; *Claude E. Robinaille* has been appointed plant manager at Grand Rapids, Michigan.

J. A. Kozma Co.—*Louis P. Braemer* of Brooklyn, New York, and the *M. A. Bell Co.* with offices in St. Louis, Tulsa, and Omaha, have been appointed as new sales representatives.

more on page 66

Two Buhler firms merge

Merger of Buhler Mill Engineering Co., Minneapolis and Buhler Brothers, Inc., of Englewood, New Jersey, was announced. The new company will be known as the Buhler Corporation with C. R. Moor as president. A new building in Golden Valley, Minnesota is scheduled for completion.

MPIF offers award

The Board of Governors of the Metal Powder Industries Federation announced that the Federation will sponsor an award for outstanding contribution to the advancement of the metal powder and powder metallurgy industry. Information is available from the Award Committee Chairman L. W. Davis, Federation headquarters, 60 E. 42 St., New York 17, N.Y.

Dow leases Wellman Bay City foundry

The Wellman Bronze & Aluminum Company of Cleveland, Ohio, has arranged to lease The Dow Chemical Company's sand and permanent mold foundry in Bay City, Michigan. The Foundry produces magnesium and aluminum castings.

Dr. Leland I. Doan, Dow president, said the move was made to remove Dow from competition with other foundries who are its customers.

Alcoa has installed a 1300 ton Kux machine

At the Hillside, New Jersey plant of Aluminum Company of America, a 1300 ton die casting machine has been installed. The machine, constructed by Kux Machine Company is used for producing aluminum auto transmission housings.

Contest is on for powder metal parts

The second annual competition for the Nonferrous Metal Powder Part Of The Year is on. There's a $500 cash award for both the product manufacturer and the fabricator who submits the brass, nickel silver or prealloyed bronze powder part that fills the bill.

Originality of application, uniqueness of design, production economy achievements and the best utilization of metal powder properties and fabricating techniques will be judged. More information is available from C. R. Maxon, Market Development Division, New Jersey Zinc Co., 160 Front Street, New York 38, New York.

more Industry News on page 68

PALMER

CRITZER

DOWNES

PORTER

KROECKLER

DeGROAT

For extruding the metals of the

SPACE AGE

PMD

is now supplying

PRECISION CAST DIES

for the extrusion of:

- CHROMIUM
- TUNGSTEN AND MOLYBDENUM HIGH SPEED STEELS
- COBALT ALLOYS
- TITANIUM
- A286 STAINLESS STEEL
- COPPER BASE ALLOYS
- STEEL ALLOYS

PMD extrusion dies are designed and built to perform to your specific requirements by experienced extrusion Engineers. These Engineers are available to anyone having tooling problems. Call or write today.

PMD

PMD EXTRUSION DIE COMPANY

5747 BEEBE AVE. • WARREN, MICH.

Phone: COngress 4-2518

Write today for descriptive brochure

Circle No. 41 on Reader Service Card

HOEGANAES
Pre-Alloyed Powders
offer you 4-star performance

★★★★ Due to their high purity, Hoeganaes Pre-Alloyed Powders can be processed with the same ease as ordinary iron powders.

★★★★ They offer excellent compressibility and high green strength.

★★★★ HSIC Pre-Alloyed Powders can be sintered at low temperatures (approximately 2050° F.) for short periods of time. Of course, they must be sintered in dry atmospheres.

★★★★ Dissociated ammonia has been found to be satisfactory for most applications . . . and if dewpoint is a problem, ordinary covering has given quite adequate results.

Best of all, you'll find that your nearby HSIC service engineer can and will work with you to the end of trouble free production. Your problems become his problems until production success is assured. You'll find he's a good man to know—why not get to know him today?

***. . . and when it comes to iron powders selection, be sure to specify* HOEGANAES**

Here's the master check list of iron powders—Hoeganaes offers a complete line of metal powders that give you the properties you want, for the metal parts properties you want to produce.

Ancor MH-100
Known throughout the powder metallurgy industry as the "work horse" of the industry. Famous as the world wide standard for uniformity, compressibility, iron carbon parts production and copper infiltration.

Ancor MH-100-S
Equally famous for the properties above, plus improved compressibility and purity. The right powder for production of large parts or higher density parts.

Ancor 80
On down the years, Ancor 80 is still the outstanding choice for green and sintered strength.

Ancor EP-1024
The popular choice for maximum purity and best compressibility.

Ancor MC Magnatite Powders
The powder of extreme purity—available in a wide range of sizes.

Ancor MH-300-P
Highest possible purity in —300 mesh size.

Ancor Flake Iron Powders
A complete line available in various sizes.

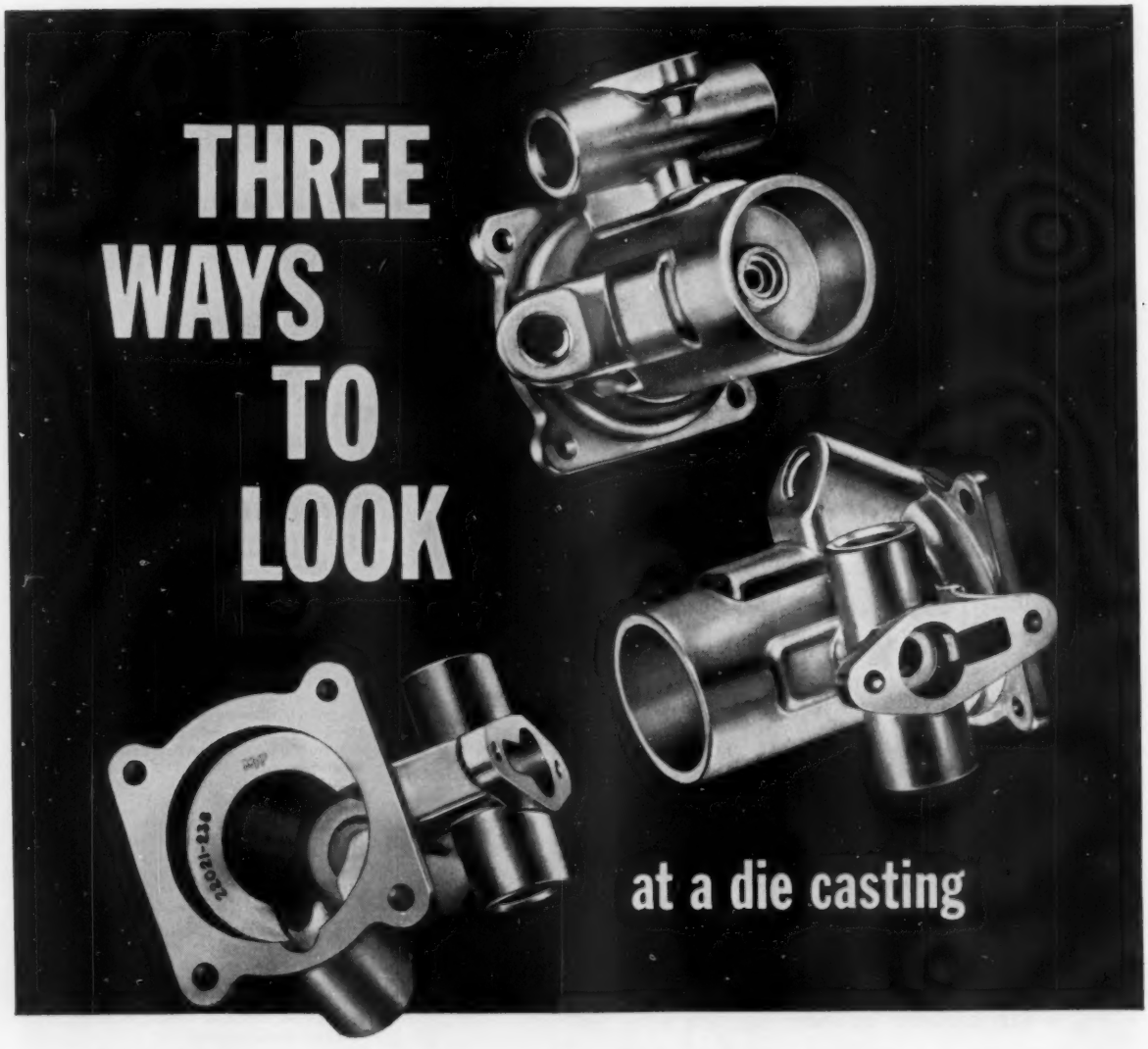
HSIC

HOEGANAES

HOEGANAES SPONGE IRON CORPORATION
RIVERTON, NEW JERSEY

SALES REPRESENTATIVES IN PRINCIPAL CITIES: Birmingham, Chicago, Cincinnati, Cleveland (Fostoria), Edmonton (Alberta, Canada), Los Angeles, Minneapolis, New England (Elmira, N.Y.), Philadelphia (Riverton, N. J.), Pittsburgh, San Francisco, St. Louis

Circle No. 25 on Reader Service Card



Madison-Kipp zinc and aluminum die castings

Here is a gas valve housing so intricate no one view could do it justice. Notice that the holes which are cast in reduce secondary operations. Cast in seats must be smooth and flat to prevent any danger of leakage. Dimensions must be held to close tolerances.

There are three ways to look at a die casting. First, the engineering that goes into the design and the skilled die making that assures perfect castings. Second, the experience of the die caster that guarantees quality parts in quantity. Third, his reliability and responsibility backed by years of die casting experience.

On all three counts—engineering, production, responsibility—Madison-Kipp has won the confidence of manufacturers who demand the finest.

We have a 24-page book showing some of the die casting problems we have solved, and containing information on other Madison-Kipp products. A copy is yours for the asking. Write for one.

kipp

MADISON-KIPP CORPORATION

213 Waubesa Street • Madison 10, Wisconsin, U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High-Speed Air Tools

Circle No. 35 on Reader Service Card

Important differences in fire-resistant fluids

Unlike petroleum oils, fire-resistant fluids have markedly different chemical properties which should be carefully considered before making a final selection.

To simplify this selection, we show here some of the variables—and limitations—of the three major fire-resistant types. Houghton is uniquely qualified for this unbiased analysis since we favor no one type over another. We make them all—and a full range of hydraulic packings as well.

1. Water-Glycol Fluids

These fluids contain water, glycol and a thickener. They provide the highest degree of fire protection. They are also compatible with the widest range of packing materials including those commonly used with petroleum oils. They should only be used, however, in systems operating at reservoir temperatures below 150°F.

Houghton's Houghto-Safe 200 and 600 Series are of this type and enjoy top acceptance and use by the armed services, as well as general industry. This wide-spread usage is due to important additives that provide *extra* anti-wear, rust inhibiting, anti-foam and metal deactivator properties to improve performance and increase pump life.

2. Phosphate-Ester Fluids

Fluids of this type are composed of straight phosphate esters and may contain small amounts of additives. These fluids can be used over the widest range of hydraulic pressures; they provide maximum lubricity for heavy bearing loads, and will stand up where ambient temperatures exceed 150°F. Packings used with these fluids must be Butyl, Butyl-Fabric or Polysulphide-impregnated Leather.

Houghton's Houghto-Safe 1000 Series are phosphate-ester fluids specially selected and compounded with additives to improve wear and rust resistance and add other proven operating benefits. Here again, Houghto-Safe 1000 Series has earned acceptance and is used on many military and space projects, as well as many of industry's toughest applications.

3. Emulsion Fluids

These fluids are either emulsions of water-in-oil (non-ionic) or oil-in-water (anionic). The following statements pertain to the water-in-oil type which are most widely used in industrial hydraulic systems.

Since these fluids are made of water and petroleum, they are compatible with standard Buna N rubber packings. They are also the lowest cost of all fire-resistant fluids. Their fire resistance is also the lowest of all three types; they should be used only in areas requiring a moderately safe fluid. The operating pressures of these fluids is generally limited to under 1000 psi.

Houghto-Safe 5000 Series designates Houghton's emulsion type fluid. It is a water-in-oil (non-ionic) fluid not affected by water hardness. Special additives are used to provide stability of the emulsion and to increase lubricity.

COMPARISON OF HYDRAULIC FLUIDS

Fluid Type	Viscosity Temperature Characteristics	Fire Resistance	Lubricity	Max. Fluid Temp. °F.	Relative Cost
Emulsion Fluids	Fair	Fair	Fair	See Note	1
Water-Glycol Fluids	Very Good	Excellent	Good	See Note	2
Phosphate-Ester Fluids	Poor	Good	Very Good	See Note	3

NOTE:—The Joint Industry Conference (JIC) Hydraulic Standards recommends the following where systems are operated continuously.

1. For water base fire-resistant fluids, the temperature of the fluid should be controlled so as not to exceed 120°F. at the pump inlet.

2. For other fluids, including petroleum oil, the temperature of the fluid should be controlled so as not to exceed 130°F. at the pump inlet.

For unusual system conditions where it is impossible to adhere to these reservoir temperature levels, the Houghton representative should be consulted.

For detailed information booklet describing all types of fire-resistant fluids, or help in selection, call your Houghton representative or write: E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

Houghton

INDUSTRY'S PARTNER IN PRODUCTION

Circle No. 27 on Reader Service Card

INTEGRATED PRODUCTION—from Ore to Ingot

Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of

Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

AZCO Zinc Die Cast Alloys

Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company

1515 Paul Brown Building, St. Louis 1, Missouri

Distributors for:

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Detroit • Columbus, O. • Chicago • St. Louis • New York

Circle No. 7 on Reader Service Card

PMM

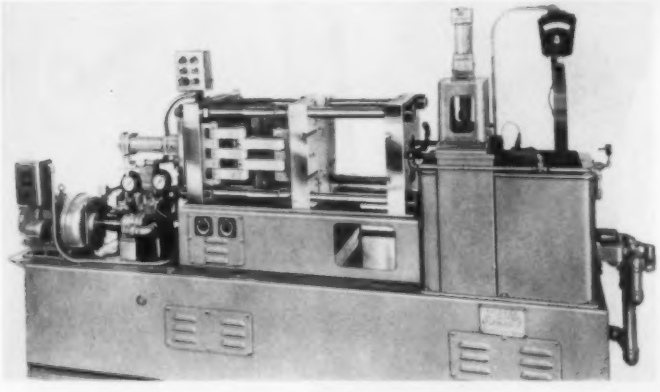
new products & developments *qualified readers can get complete details on these products. Use the reader service cards.*

Deburr castings with plastics to get a natural finish

THE FIBER RESIN CORP.—A new plastic media for vibratory deburring machines has been perfected by the company. Deburred parts come from a barrel or vibrator with a fine matte surface, clean and natural color. The plastic media combats discoloration by maintaining dirt free work piece surfaces. The particles weigh approximately 72 lb. per cu. ft. and will make vibrators work better.

Shown are unused parts mixed with those that have been in use a full sixty hours.

Circle No. 235 on Reader Service Card



Redesigned for fast action

AMERICAN DIE CASTING MACHINERY CO.—Two changes have been made on this 150-ton locking pressure die casting machine. Its new hydraulic combination pump delivers 21.8 gallons per minute—double the previous delivery. The machine will complete 1300 free cycles per hour—2.8 every second. This new hydraulic development helps regulate pressures between the clamping cylinder and shot cylinder, to isolate one from the other.

Circle No. 236 on Reader Service Card

New electric furnace melts to 2300°F.

JELRUS TECHNICAL PRODUCTS CORP.—The Electro-Melt is a new high temperature (2300°F) crucible furnace for melting metals, heat treating, sintering, ceramic firing and general research. Muffle dimensions are four inches I.D. by 7½ inches high. Metal melting capacity is five pounds o fbronze. It is equipped with automatic temperature controller and thermocouple failure protection, and is available for voltages from 115 to 230 a.c. Thirty minutes in a hot furnace will melt five pounds of bronze.

Circle No. 237 on Reader Service Card

more New Products on page 81

Casting research on 17-4PH increases elongation 10% . . . costs Cannon-Muskegon customers nothing ¶ Cannon-Muskegon research has developed certain procedures for investment casting of 17-4PH that assure, consistently, the high level of properties which this alloy is capable of producing. ¶ Casting test bars in a keel block arrangement as shown here—rather than an end-gated arrangement—is one of them. Special recommendations on aging time and temperature are another. ¶ Further, Cannon-Muskegon research has demonstrated the necessity of stricter limits to provide a balanced chemistry and prevent harmful effects induced by too high or too low a content of certain elements. Keeping within these limits and following Cannon-Muskegon recommendations assures investment casters of consistently obtaining optimum performance from this fine alloy. ¶ We invite you to write for a free copy of the ICI Technical Research Report, "The Effect of Aging Time and Temperature on the Mechanical Properties of Investment Cast 17-4PH."

MASTERMET
AIR-MELTED ALLOYS

CANNON-MUSKEGON CORPORATION
Metallurgical Specialists • 2871 Lincoln Street • Muskegon, Michigan

Circle No. 14 on Reader Service Card

Brown Boveri three-ton line-frequency coreless induction meltdown furnace

PREVIEW: FOUNDRY OF THE FUTURE

Early in 1962, in a German plant, *a single operator* at a central console will supervise the "punchcard" operation of an entire gray-iron foundry . . . including charging and meltdown in nine 5½-ton induction furnaces; the automatic alloying, analysis and correction of the melt; and the automated casting strip. The furnaces and automation equipment are now being engineered and built by Brown Boveri.

The furnaces will be Brown Boveri line-frequency coreless induction units similar to that in the photo. Here is why this furnace is rewriting foundry technology:

It produces superior, more uniform metal. It is clean and cool to operate. It is simple, rugged and foolproof, thus ideally suited to automatic control. It is low in cost. (For example: the nine-furnace set-up *including all controls* will cost substantially less than cupola-and-induction furnace duplex equipment.) And the furnace design has been proved by *hundreds* of installations in the U. S. and throughout the world . . . with a total capacity greater than that of any other manufacturer.

Furnaces are available in all sizes . . . for melting, holding or superheating . . . for any metal. Write for application study. Address Brown Boveri Corp., Dept. 3, 19 Rector St., New York 6, N.Y.

BROWN BOVERI

Circle No. 87 on Reader Service Card

Why you can be sure . . .

Celanese Cellulubes are the best functional fluids you can use

There are four practical reasons behind our claim that *you just can't buy better fire-resistant hydraulic fluids or air compressor lubricants than Celanese Cellulubes.*

1

BASIC PRODUCER—Celanese was the *first* to produce phosphate esters . . . and is the *only* producer currently marketing a series of industrial phosphate ester lubricants. Experience has demonstrated that we now have one of the best equipped plants in the country.

2

APPLICATION ENGINEERING—Our files contain facts about hundreds of successful Cellulube applications in many industries. Celanese engineers have the experience and interest to help you make the most of these functional fluids.

3

QUALITY CONTROL—Celanese zealously guards the quality of Cellulubes by a system of constant checks and controls. Physical and chemical properties are strictly maintained within exacting limits to assure you of optimum performance for fire-resistance and lubrication. What's more, Cellulubes have passed the most rigorous tests that the military and some of America's largest companies could devise.

4

TECHNICAL ASSISTANCE—Our technical staff provides assistance to see that the changeover from conventional fluids to Cellulubes is made as quickly and easily as possible. In many cases, our salesmen provide all necessary conversion know-how.

Fire-resistant Cellulubes are available in *six* controlled viscosities. Not only are they outstanding for the prevention of fire and explosion, but they give overall wear protection comparable to premium petroleum oils. Get the complete facts by using the coupon below. Celanese® Cellulube®

Celanese Chemical Company, Dept. 589-C
180 Madison Avenue, New York 16, N. Y.

Please rush me a copy of your manual on Cellulubes as
☐ hydraulic fluids ☐ synthetic lubricants

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

Celanese CHEMICALS

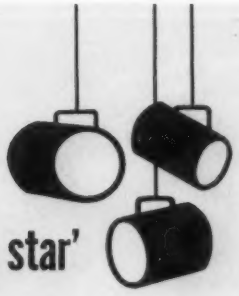
FM Factory Mutual-Approved (Cellulubes 150 and 220)

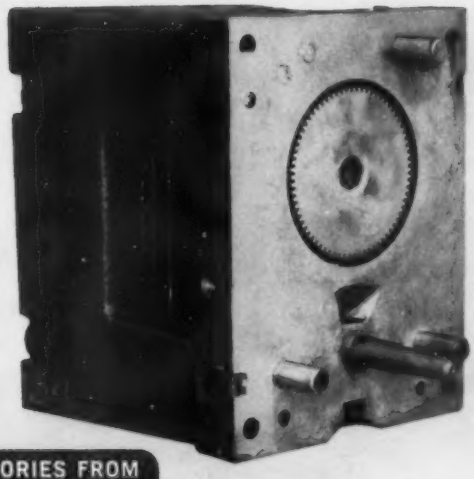
Bureau of Mines-Approved #30-2

Celanese Chemical Company is a Division of Celanese Corporation of America.
Canadian Affiliate:
Canadian Chemical Company Limited, Montreal, Toronto, Vancouver.
Export Sales:
Amcel Co., Inc., and Pan Amcel Co., Inc., 180 Madison Ave., New York 16.

Circle No. 15 on Reader Service Card

48 years ago Mt. Vernon created this 'movie star'





CASE HISTORIES FROM MT. VERNON FILES

. . . and here's why the original die is still performing

Back in 1912 in the days of the nickelodeon when the movie industry was in its infancy, the people who made Simplex theater equipment needed a quality die-casting job. They turned to Mt. Vernon for a die that would turn out the gear end for a hand operated film rewinder.

That was Mt. Vernon's 34th die. Yet even today, 48 years later, the original die continues to turn out these same gears *without a single change*. The movie industry still uses Simplex Film Rewinders, and Cinesound Service Corporation of New York who are the current manufacturers still rely on Mt. Vernon to produce the castings.

The fact is that Mt. Vernon's original die proved itself in actual use . . . despite all the myriad changes in die-casting techniques and machines since 1912. For our dies are built to give *continuing* top performance . . . backed by the stability and reliability of a firm that is already in its second half-century.

When you are in the market for die castings think first of Mt. Vernon. We have the abilities to make long lasting dies . . . we have the stability and reliability that insure dependable service . . . not for only a year, or ten years, but for 48 years and more if need be. Contact any of our Field Salesmen. They're eager to help you also make a 'Star'.

MT. VERNON DIE CASTING CORPORATION
STAMFORD, CONNECTICUT

FIELD SALESMEN

BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St.
BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Grant Eller, 6 East 194th St.
MARIETTA, N. Y.: Mr. Burt J. Meldrum, Olanco Road
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

Circle No. 34 on Reader Service Card

BETHLEHEM CROMO-HIGH V TOOL STEEL

...ideal for casting in the 1200 to 1300 F range

If you are die casting aluminum-base or magnesium-base alloys at about 1200 F to 1300 F, you will find Bethlehem Cromo-High V tool steel (AISI H-13 type), one of the most economical choices you can make.

Cromo-High V is ideal for die casting in this temperature range because of its 5 pct-chrome, high-vanadium content. Cromo-High V is economical because it comes in the annealed condition to Brinell 207, and therefore is easy to machine. This die casting grade strongly resists the formation of a fine network of heat checks. Moreover, Cromo-High V develops uniform hardness in large sections during heat-treatment, enabling it to resist wash and erosion.

Typical Analysis

C	Cr	V	Mo	Si
0.40	5.25	1.05	1.25	1.00

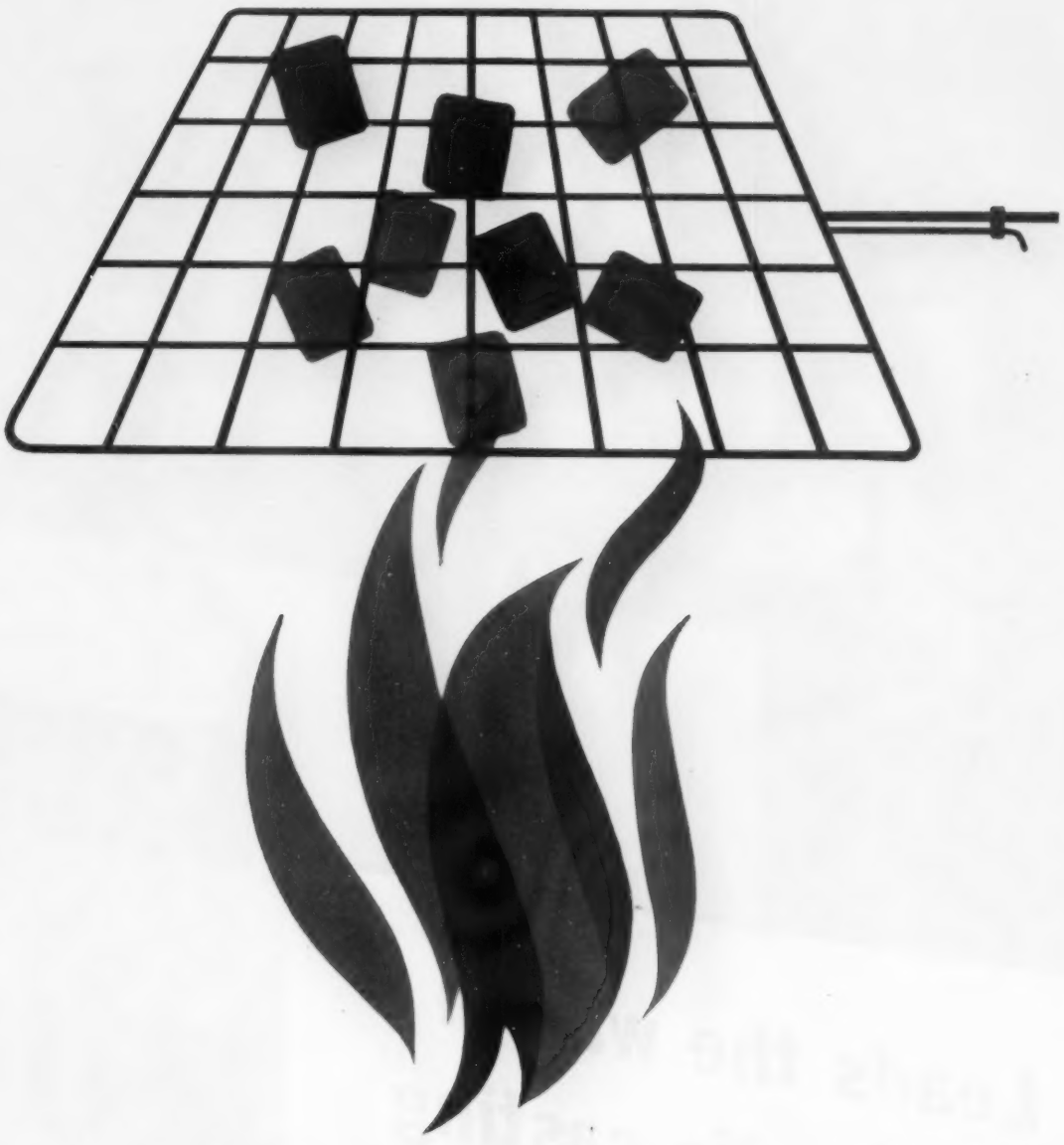
Put Cromo-High V to work at your first opportunity. Your local Bethlehem tool steel distributor will be pleased to work closely with you.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Circle No. 12 on Reader Service Card



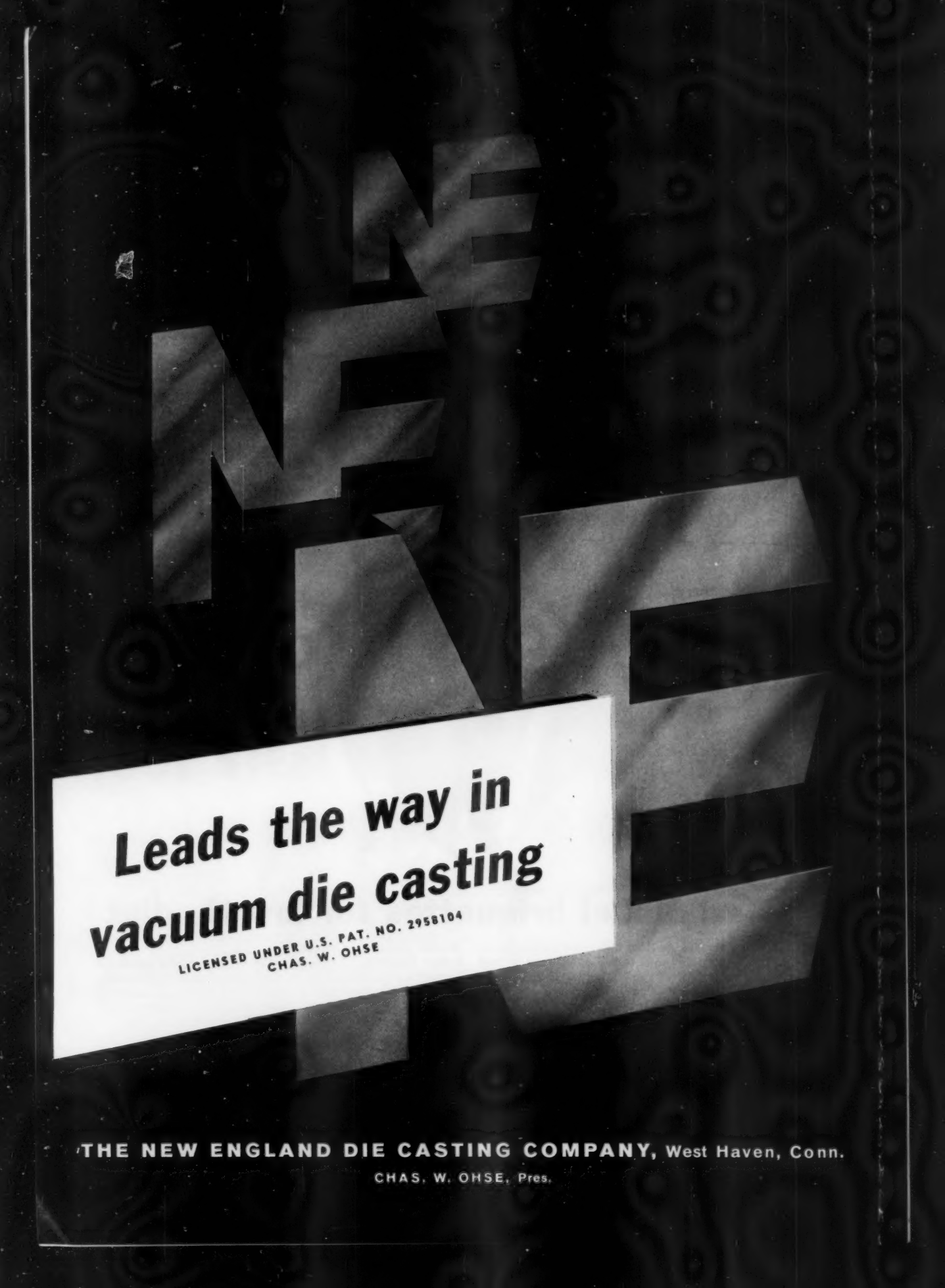
toasted nickel briquettes for low H_2 diet

Sherritt's recipe for making low-hydrogen nickel is as effective as it is simple: take pure nickel powder, press into uniform briquettes, and heat for a quarter of an hour at 1650°F. The result: pure nickel in its handiest form, with scarcely a trace of hydrogen. High-purity Sherritt nickel is also available in three standard grades of powder, special grades, and coated powders.

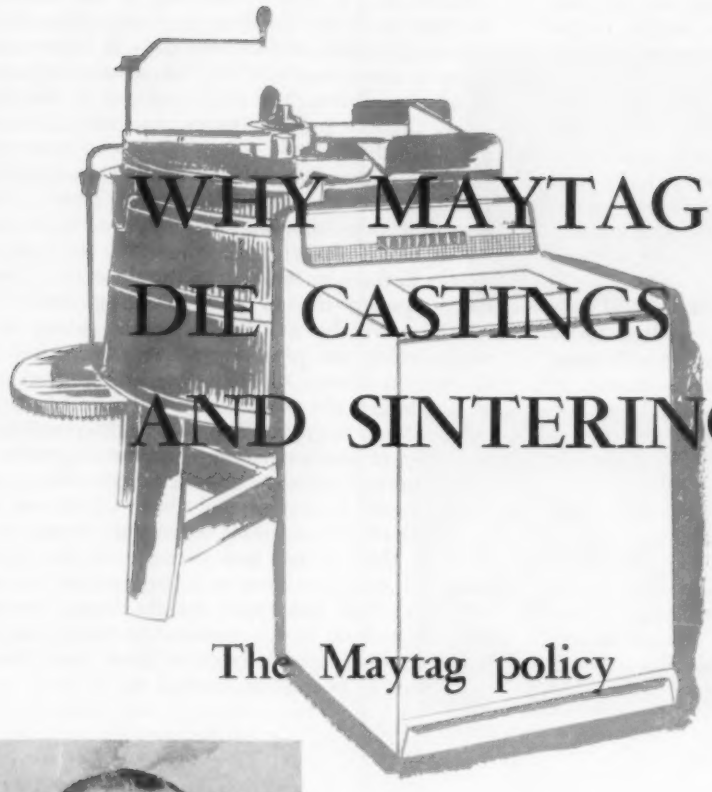
FOOTE MINERAL COMPANY *is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For complete illustrated brochure with prices and delivery information, contact the Foote Mineral Company, 474S Eighteen West Chelten Building, Philadelphia 44, Pa.*

SHERRITT GORDON MINES LIMITED

Circle No. 80 on Reader Service Card


NE
NE
Leads the way in
vacuum die casting
LICENSED UNDER U.S. PAT. NO. 2958104
CHAS. W. OHSE
THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.
CHAS. W. OHSE, Pres.

Precision Metal Molding
MARCH 1961



WHY MAYTAG USES DIE CASTINGS AND SINTERINGS

The Maytag policy

As told to PRECISION METAL MOLDING *by*
GEORGE M. UMBREIT, *President, The Maytag Company*

"ARTIFICIAL OBSOLESCENCE has absolutely no place in the corporate thinking at The Maytag Company. Our aim is to build home laundry equipment which will give our customers the longest possible trouble-free service. At present, our goal is a minimum of ten years of normal use without any major repairs. We haven't gotten there yet, but we are making significant progress.

"Our basic policy was laid down by the late F. L. Maytag, who founded this company. This policy, briefly, is never under any conditions to degrade quality. Never make a change which you know will lessen the quality of the product. Always try to reduce costs, but not at the expense of quality. This basic policy has been amplified to never make a change just for the sake of change. If we can offer a better product or a new feature in a product which performs a useful function, then we will change. This same thinking is followed in price. If we can change a product to give our customers as good a product as before, but at a

lower price, then again we will make changes.

"This same policy is followed in our dealings with our vendors. There is no stricter quality control in the appliance industry. We won't always buy from the lowest bidder. Only when we are convinced that quality of the product, ability to deliver on schedule, and other factors are equal does price become the dominant factor.

"Geography enters into this also. Situated in mid-Iowa, as we are, our lines of communication are generally long and if we are to have a steady flow of acceptable components we must establish rigid quality control. In that way, we can schedule manufacturing and assembly so that there is a smooth, uninterrupted flow of material and parts without carrying large inventories.

"There's another point also. Maytag policy is to supply repair parts for any of our models. There are many washers still in operation which were built during the 1920's. As long as the owners of these washers are satisfied with the laundering job they do, we will supply them with the necessary parts to keep them working. Here only top quality in parts can possibly do the job.

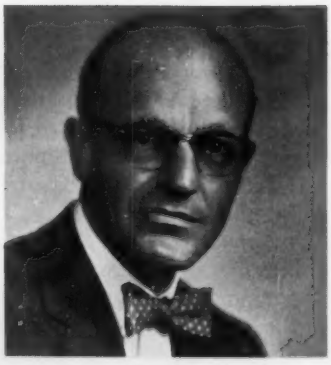
"Now much of what I have said has dealt with our insistance on high quality components. This is the reason we use so many components made by die casting, sintering, permanent mold casting, and are looking into extrusion. With these products we believe that the very best laundry equipment can be made at the very lowest possible cost. What's more, these parts are a big help toward our goal of the ten-year appliance.

"As to the future of the laundry equipment industry—First I believe that the most barren field of human pursuit is prophecy. Against this background I believe it is a dynamic industry. It has shown in the past its ability to adjust to changing products, changing conditions. I see nothing that says we are going to slow down to a stop, in terms of adjusting to new conditions. We are a segment of the consumer durable goods industry. As there are more people in this country and in the world, there will be more demand for our products. Consequently, I believe that there will be a parallel between the growth of population and the growth of our industry. It will be affected, of course, by the cyclical swings in the economic cycle. But generally, I look for an upward—though not explosive—growth.

"There will be changes, of course, which may well obsolete our present products. These may be changes in fabrics, or technological improvements in laundering. But the industry will adjust to them and continue to grow. This gives us the possibility, naturally, of another period of explosive growth.

"But normal economic growth is tied to the population, family formation, and above all the rise in the standard of living. This means that in some sections of this country and in some of the South American countries there is a large potential market which will be tapped by the home laundry industry as soon as the standard of living rises to the point where people begin to think about these appliances as necessities, instead of luxuries."

Design and development in laundry equipment



Based on an interview with
T. R. SMITH, *Vice-president, Research & Development, The Maytag Company*

THE ONLY REAL DRIVING FORCE to better design and development is competition. This does not mean the addition of meaningless pushbuttons, gadgets, and gimmicks which make a mechanical monkey out of the housewife. It means the steady development of simpler, better equipment which reduces the homemaker's work and does a better laundering job.

Intelligent design must also take into account the great differences in people. Just as the sports car enthusiast likes to shift gears while other people wouldn't consider a car with a

stick shift, so some housewives want a highly automated appliance while others prefer to make some of the decisions themselves.

To satisfy the varying needs and wants of homemakers in laundry equipment, Maytag—in addition to producing washers offering manual selectivity and maximum flexibility—also has designed and marketed a completely programmed washer control which on the touch of a single button automatically makes the appropriate selection of laundering conditions.

Now what does all this have to do with die castings, sinterings, and permanent mold castings? Simply that with these processes it is possible to design components which will do the job and these parts can be made economically.

Research no longer designs for sand castings. They cost too much. If a part requires a contoured surface, that surface is die cast to final shape and tolerance. Contour milling, end milling, and similar operations are so expensive that a process or material which requires them to finish a part is rarely used.

Of course during the development of equipment, parts are often sand cast. This is only prototype work, however. Every part which is made as a sand casting and then machined to final size and shape is capable of being die cast or permanent mold cast. As a matter of fact, research seldom designs for permanent mold cast parts. At the present time there are only about three of them in use. A gear case and cover in aluminum and a gear blank in iron. Other than these, all castings are die castings.

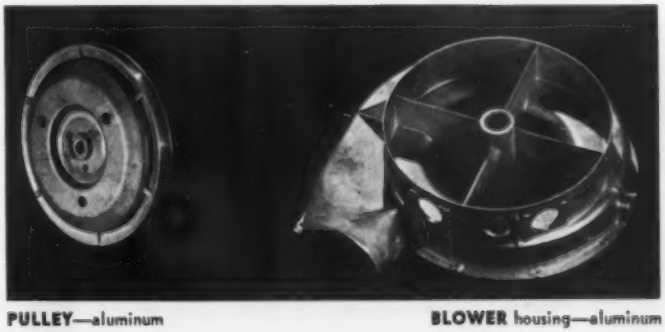
Another point that should be stressed is the constant consultation between research and the vendors. While Maytag makes some of their own die castings, they still purchase a lot of them outside. They have learned that by close cooperation with the vendors of castings they get a better, less expensive, more functional part. Normally, Maytag designers know what can

DIE CASTINGS in both zinc and aluminum are used widely in the manufacture of laundry equipment. Here are just a few used in current production.

WRINGER gear case—zinc

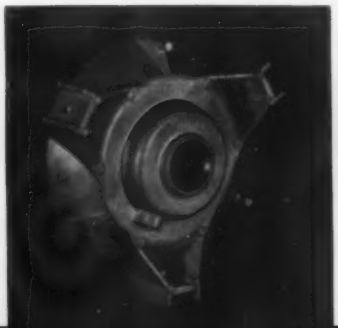
BOTTOM plate—aluminum

MOUNTING stem—aluminum



PULLEY—aluminum

BLOWER housing—aluminum

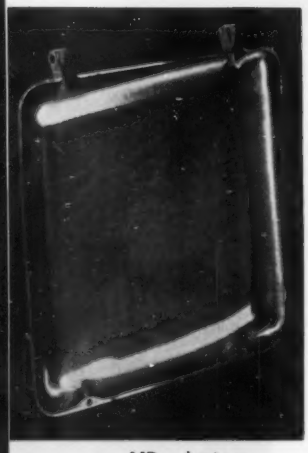


DAMPER—aluminum

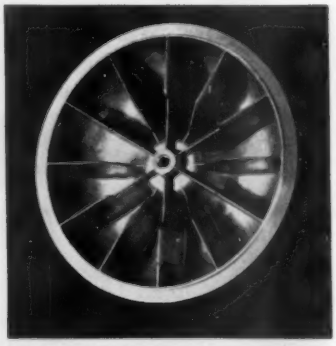
more die casting on next page

MORE DIE CASTINGS used in Maytag washers and driers

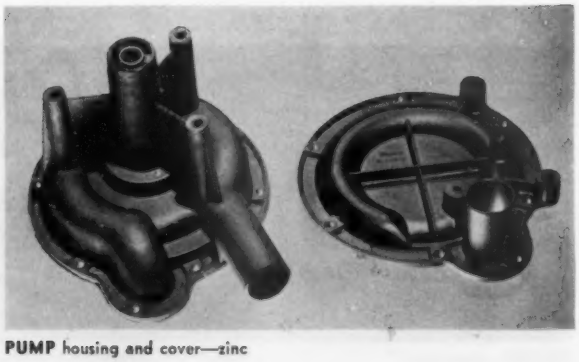
WRINGER post assembly—zinc



LID—aluminum



IMPELLER—aluminum



PUMP housing and cover—zinc

WRINGER frame—zinc

or cannot be done by the foundry. But even so, from time to time a dimension or a tolerance will be slipped in which is unnecessarily tight or even meaningless. These are eliminated before final design is reached.

Then in the design of laundry equipment there are a lot of factors to consider which don't apply in other home appliances. For example, in a washing machine you have considerable abrasion due to sand particles. You have high corrosion rates due to the rapid flow of water and then the corrosive effect of detergents and bleaches. Temperature enters into this also. In some cases you are dealing with very hot water followed by quite cool water. This creates problems in the expansion and contraction of parts. Add onto these problems load factors and you begin to get a a pretty complex problem to solve.

It's all of these factors which may define the materials of construction pretty rigidly. What's more, there isn't anything that can be done about most of them. The conditions are set and research must design to live with them. For instance, on a pump where there is a lot of abrasion, errosion and corrosion from detergents it was found that metal components, even with a protective surface coating, failed. This was especially true in coin-operated laundries where the equipment might be in use 24 hours a day. For this application Maytag has gone to a polypropylene pump. This seems to be a good answer. This example shows how service conditions can determine the type of material used even though another material might be more economical.

Getting back to the subject of materials selection for a moment, in many cases it would seem that either zinc or an aluminum die casting could be used. The choice would seem to depend on the cost of the metal and the casting costs. In some cases this is true. But if, for example, an insert must be pressed into the casting which will later be subjected to furnacing or

peening, you would use an aluminum casting since these operations would cause a slight relaxation of zinc and a loose fit on the insert. This same thing is true when normal operation causes a part to run hot. Take a gear case, for example, with bushings pressed into the casting. If it runs hot the zinc die casting may relax and give you loose bushings. In both of these cases, aluminum is quite stable and perfectly satisfactory.

On the other hand, where good finish is required or where reproduction of detail is important, then zinc is by far the more preferred metal.

Sometimes, of course, you must go to still another metal to get the properties you require. For example, certain gears in either zinc or aluminum, with high loading, would soon gall. For these applications Maytag uses gears machined from steel and cast iron blanks.

Generally, design and development work is from one to three years ahead of a model introduction or design change of any sort. This gives adequate time for basic design, prototype testing, and life testing by the development sections, the factory, and the sales department. Maytag also puts appliances into homes for testing under normal usage. Any bugs which might show up during this period are corrected before the new model or new component goes onto the general market. This assures the purchaser the best possible appliance, and avoids artificial obsolescence of Maytag products.

The role of production engineering

Based on an interview with **W. A. IRVINE**, *Mgr., Production Engineering, The Maytag Company*

THE MAYTAG COMPANY'S research and development division, in designing the company's products, specifies the shape, size, materials and finish for all of the component parts that are assembled into Maytag products.

The production engineering department of the manufacturing division provides the manufacturing facilities, such as equipment, tools, dies, molds and fixtures, necessary to translate the designs into production.

Maytag has facilities for making an unusually large proportion of the component parts. These include zinc and aluminum die castings, aluminum permanent mold castings, aluminum extrusions, and bronze and iron sintered metal parts.

With such a wide range of manufacturing facilities, it is possible, at times, to make a given part by several different methods.

The use of zinc and aluminum die castings, sinterings, and some aluminum permanent mold castings has given better control over the quality of parts delivered to manufacturing and/or assembly, and has given a smoother flow of material without the need of large inventories.

Some of the advantages obtained by a change in manufacturing methods are given below.

BOTTOM PLATE—Aluminum Die Castings—Figure 1

This part was converted from an aluminum sand casting to an aluminum die casting. The present die casting costs about 40% less than the sand cast aluminum part. The sand casting was made in Maytag operated foundaries.

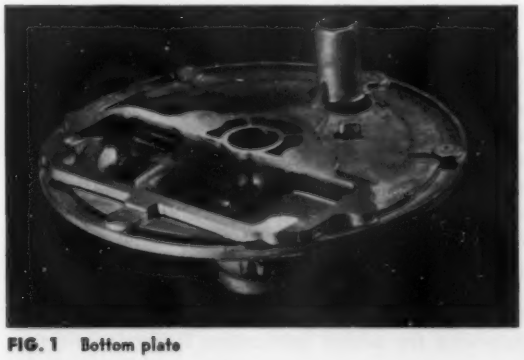


FIG. 1 Bottom plate

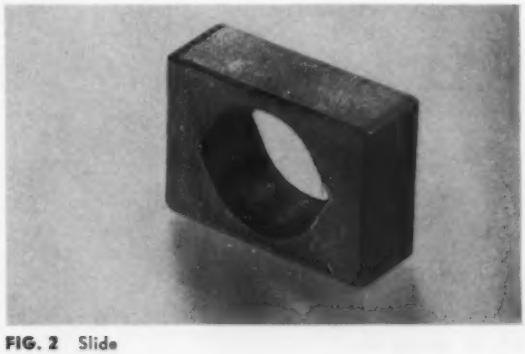


FIG. 2 Slide

Machining operations on this part are quite simple and, for the most part, are done on either a drill press or drilling machine. One milling operation is required on the gasket face to provide an oil tight seal.

The plate is pressure-tested under water for leaks from porosity.

SLIDE—Iron Sintering—Figure 2

Before 1943 this part was made as an iron sand casting. It required over-all machining and a considerable amount of metal had to be removed to secure the dimensional accuracy and surface finish required. It was then changed to a sintered iron part at a substantial cost reduction. Among other savings was a grinding operation on all six faces of the block.

SPLINE—Extruded Aluminum—Figure 3

This spline was made as an aluminum die casting. It was necessary to remove taper in the die cast internal splines by a broaching operation.

This part is now cold-extruded without taper in the splines, which eliminates the broaching operation. Cold working the metal during extrusion increases the resistance to wear. The saving will be about one-third.

BEARING LINER—Sintered Iron—Figure 4

This liner was originally made from stainless steel tubing. It is now being made by machining from a sintered iron tubular blank. As the wall thickness is too thin to be compacted and sintered, machining is necessary to remove the excess metal. The cost saving has amounted to more than 40%.

On this part the operations required to complete the liner by both the old and the new methods are a good example of the savings that are made by the conversion in production methods.

Old Methods	New Method
1. Unload and deliver	1. Unload and deliver
2. Receiving inspection	2. Receiving inspection
3. Machine on automatic	3. Ream I.D., break edges
4. Face to length and deburr	4. Turn O.D., entire length
5. Turn O.D., entire length	5. Chamfer and countersink
6. Finish grind O.D. entire length. 8 grinds	6. Finish grind, O.D., entire length. 3 grinds
7. Break sharp edges of O.D.	7. Oil impregnate
8. Passivate	

While this listing of operations does not seem to show much difference note that final grinding to size (item 6, above) on the O.D., requires 5 fewer operations for the sintering than for the tubing.

Because of its dependence on sand castings, the Maytag company used to operate its own sand casting foundries for both grey iron and aluminum castings. About four years ago these foundries, which were very highly mechanized, were discontinued and the space used for other manufacturing operations. This change was dictated mostly by the change from sand castings to die and permanent mold castings. A few iron sand cast parts are still used, but investigations are being made to determine the possibility of converting these parts to either die or permanent mold castings.

There's another reason for the wider use of die cast parts. Many components are so complicated in design that it would be virtually impossible to make them as sand castings and then do the required machining. As die castings there are many surfaces which may be used as-cast. These surfaces would present a very serious machining problem if the parts were sand cast.

There are other reasons for the change to the so-called PMM parts. Weight is one. Maytag ships laundry equipment all over the country and overseas. Every ounce which can be saved lowers shipping costs. On the other hand, for some products there is a minimum weight required to give stability. The automatic washers and the combination washer-dryer units require sufficient mass to prevent movement on the floor. These desirable weight distribution factors are most easily secured by designing for PMM parts.

The use of die castings and sintered bushings has another very great advantage. Where a bushing is used in a cast part it is always pressed into a cored hole, never cast in as an insert. The accuracy of the die cast parts is good enough so that a light cut on the I.D. of the bushing is enough to size it and to hold center distances within tolerances. With sand castings, on the other hand, a precise boring job had to be done first, the bushing then pressed in, and finally the I.D. reamed to size.

Naturally the oil retention properties of sintered bushings make design simpler. In most cases no provision for added lubrication is needed.

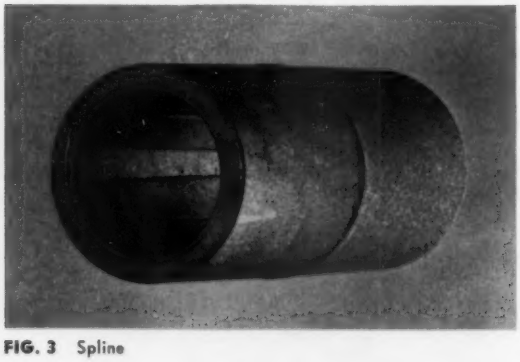


FIG. 3 Spline

FIG. 4 Bearing liner

Purchasing practices and policies

WM. F. LANGEFELD
Director of Purchases, The Maytag Company
interviewed by the Editor of
PRECISION METAL MOLDING

When you purchase such parts as die castings or sinterings, do you send out general requests for bids to all known suppliers or do you have a select group from whom you generally purchase?

Our normal policy is to employ sources of supply which are known to us, favoring those sources whose proximity, quality, service and efficiency warrant special consideration. In making outside purchases of sinterings, we employ two or three sources. Because we are always seeking new suppliers, we add new names to our inquiry list when new buys or rebuys come up, dropping the names of those with whom we have no apparent mutuality.

When you are considering a new vendor what factors other than price do you consider?

In initiating a relationship with a vendor, who is new to us, we employ Dun & Bradstreet reports, industrial references and make a plant inspection, to appraise the vendor's abilities and facilities. While the record of union contract expiration dates in our vendor files is far from complete, we must be very sensitive to labor developments which might endanger our procurement.

How many vendors do you try to have?

While we do try to provide two sources for all of our requirements, that policy must be modified when we are faced with high cost of duplicate tooling, limited quantity requirements or other special considerations. The circumstances existing at the time govern our actions when we are faced with an interruption of deliveries on a single source item. Whether we rely on heavier inventories, transfer of tooling, substitutions or other means must be dictated by the circumstances existing at the time the emergency arises, even though tentative alternates were established at the time we decided not to provide a second source.

Suppose that you set out to buy some zinc die castings which require considerable machining and which have to be chromium plated. Would you prefer to buy from an integrated producer who could deliver a completely finished part or would you buy a trimmed casting and do the machining and plating yourselves?

It has been our practice to purchase die castings which require plating after machining. As a general rule, we prefer to undertake machining with our own facilities, even in the case of die castings.

During the design of a new model, or the redesign of an older one, does purchasing work with engineering in any way?

We cooperate with the design engineering personnel in developing sources for a new requirement, obtaining recommendations and suggestions from such sources before the design is finalized.

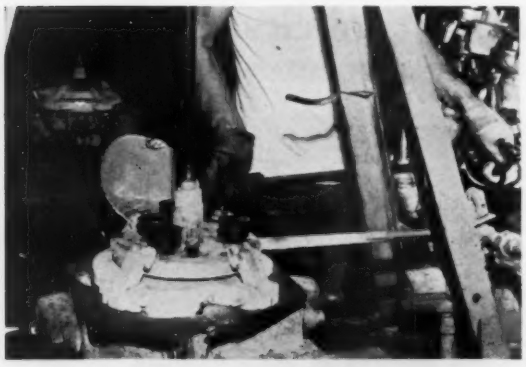
Do you use any sort of a vendor rating system?

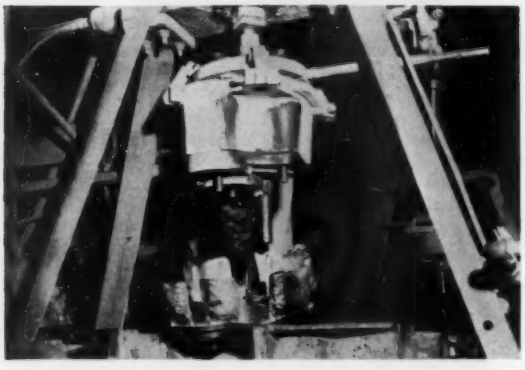
While we do not employ a formalized vendor rating system, we reappraise each vendor's performance when a new buy or rebuy arises. On items of major importance, possibility of a change in source is reviewed with all of the interested areas; that is, quality and inspection, design engineering and line supervision. Even the vendor's handling of paperwork, which is usually an accounting problem, is evaluated in rating a vendor, since no organization can afford to spend excessive time and effort in analysis and correspondence to correct sloppy paperwork on the part of a supplier.

After you have selected a vendor, or group of vendors, do they work with your design and manufacturing departments to simplify design and reduce costs?

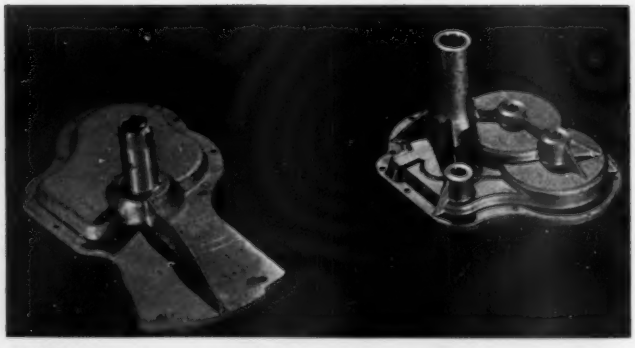
We are always seeking recommendations and suggestions, not only on our initial inquiry, but also in our conversations with sales representa-

PERMANENT MOLD CASTINGS are used where special properties or metal are required.



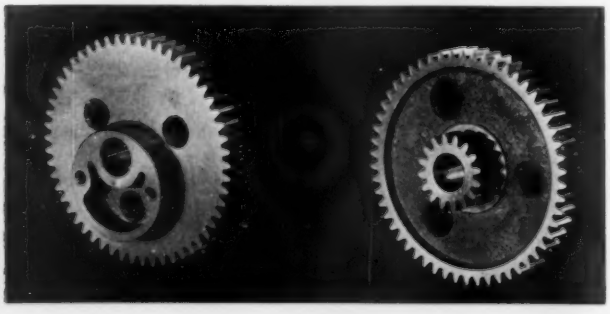


FIVE ALUMINUM permanent mold castings are used. Top—pouring a casting, and bottom—removing the casting.



GEAR CASE and cover cast in aluminum (above).

MACHINE GEARS from cast iron blanks. Lower left—gear for Pit main drive, and lower right—intermediate gear.



tives and other vendor personnel. Such suggestions and recommendations must be evaluated by our design and test groups to determine their acceptability. Cost reduction, improved quality, reliability or improved availability are some of the incentives which must be present if re-evaluation is to be undertaken after the design has become finalized.

What do you do when one bidder, out of a group, comes up with a price that is way below any other?

Because the circumstances attending such a situation are so complex, no policy declaration can cope with the many variations. We can only say that the validity of an unusually low quotation must be carefully probed. It is not unusual for us to ask the bidder in such a case to reaffirm his quotation after verifying his cost elements.

Suppose he rechecks, comes up with the same low figure, gets the contract and then later finds out he is losing money?

Again, the circumstances can vary too greatly to permit even a general answer. Obviously no relief can be granted on a charitable basis; it must be identified with immediate need or a future benefit.

Your engineering department always makes cost estimates of course. How closely do you stick to these estimates in dealing with vendors?

The preliminary estimates of the engineering department are frequently based on quotations which the purchasing department solicited for a tentative specification. The initial production cost is determined by the prices quoted for the final specification. If unusual differences exist between the estimates and the final costs, they must be carefully studied to determine the cause and accomplish the most acceptable correction.

Do your contracts carry escalator clauses for changes in metal prices or penalty clauses for late delivery?

We seldom permit inclusion of an escalator clause to com-

pensate for changing raw material prices. In the relatively stable markets that prevail at the present time, the vendor should be able to protect his prices on the raw material requirements at the time he receives our purchase order. However, die castings involve fluctuations of the published prices for zinc and aluminum, and the contracts must provide for those fluctuations. While no penalty clauses are included in our contracts, the implied penalty is always present, that of the loss of future business.

In the case of both die castings and sinterings, it is common practice for the buyer to pay for the tooling which the vendor uses and maintains. If you should change vendors do you have any trouble with release of toolings?

While exceptions are sometimes made, our policy requires that our tooling for production in vendor plants be distinctly designated as the exclusive property of The Maytag Company. We seldom employ our right to transfer tooling, but it appears safe to say that the loser always raises objections.

Under those conditions, then, you have to pay for engineering design in addition to the cost of tool manufacture?

Unless we have already designed a tool, we expect the engineering design to be included with the cost of manufacture to arrive at the total cost of tooling.

How far afield, geographically, do you go to purchase die castings?

Some of our purchases of die castings are made from sources at a considerable distance from Newton. We prefer to purchase our die castings from sources in what we consider our general market area, rather than invite transportation penalties.

How about rejected material? What is your general policy?

Rejected material is returned to the vendor, usually for replacement. The vendor must determine whether sorting is required and whether the rejects are salvageable. In some cases, when the rejection has been made on a quality control basis, the vendor is permitted to send a representative to perform the sorting in our plant. If we have performed machining or other operations on die castings which are subsequently rejected, we may be forced to absorb the labor which has been lost in performing the operations, but the nature of the defect and the vendor's responsibility would determine the extent of our claim.

Our vendors are expected to meet our specifications and standards meticulously, provide adequate service, make shipments as scheduled, at price levels determined competitively by "quality" producers.

Powder metallurgy operations at Maytag

WALTER ANDERSON, *(left)*
Supervisor, Quality Control, and
WESLEY BISSETT, *(right)*
Plant Manager, Hampton Plant
interviewed by **P. R. KALISCHER,** *(center)*
Editor PRECISION METAL MOLDING

MOST OF THE SINTERINGS which go into Maytag laundry equipment are made in-plant; all but two of these are bushings.

In all, the Hampton plant makes 38 different parts with a monthly production of 5 million pieces. Practically all of the parts are a copper-tin alloy.

By making their own sinterings it has been possible to regulate production so that there is a smoother flow of material through the assembly departments without the need for large inventories of parts. The location of Maytag's plants, some distance from major industrial centers, prompts them to be self-sustaining.

Problems common to the powder metallurgy in-

dustry were, of course, encountered at Maytag and their solutions can point the way to better quality control throughout the industry.

Most of the bushings used are pressed into cast or machined holes with sufficient interference to cause a very slight decrease in the ID. To correct this sizing problem and to assure the precise center distances required, the bushings are bored after they are in place. Generally, a single point carbide tool is used for this operation.

Years ago, trouble was encountered in this machining operation. Hard spots in the bushings made machining difficult and sometimes prevented an accurate machining job.

Investigation led to finding many causes for hard spots. As a result, a stringent quality control program on both incoming powders and finished bushings was set up.

On each shipment of powder ordered, a 100-lb. preview sample is submitted. This sample is tested by actual production of a standard size bushing which is then given both strength and machinability tests. Only after the test sample has been passed, and this includes chemical analysis also, is the shipment released.

While all suppliers are required to furnish certification of quality with their powders, it is likewise Maytag's policy to complete all tests before releasing the powders for shipment.

But control does not end with the incoming powders. After the sample lot has been accepted and shipment received, an identical series of tests is run on the large shipment. Any variation here can be cause for rejection.

During production, spot checks are made by the press operator and the laboratory to make sure that the green pressings are up to specifications on green strength and dimensions.

The furnace is under frequent control. The operator checks hourly and the laboratory makes spot checks on temperature, gas quality, etc. At least once a week all controls, thermocouples and instruments are checked by the laboratory and the operators run checks every morning and evening on selected items. Periodically, at least once a week, a thermocouple is run through the furnace to check temperatures of the parts on the belt.

As the parts are discharged from the furnace they are inspected for dimensions such as OD, ID, and length. This permits segregation into lots to make sure the bushings will size properly.

It was noted that some bushing designs, and particularly those from certain shipments of powders, would distort in sintering leaving the diameter at the center smaller than at the two ends. It was found necessary to pre-size these in order to reshape them properly in the final or standard sizing operation, thus the need for segregating at the furnace.

After sizing, the parts go to impregnation and then final inspection. The final inspection is a random sample from each batch impregnated. Should any off-standard bushings be found at this stage they are isolated and either reworked or scrapped.

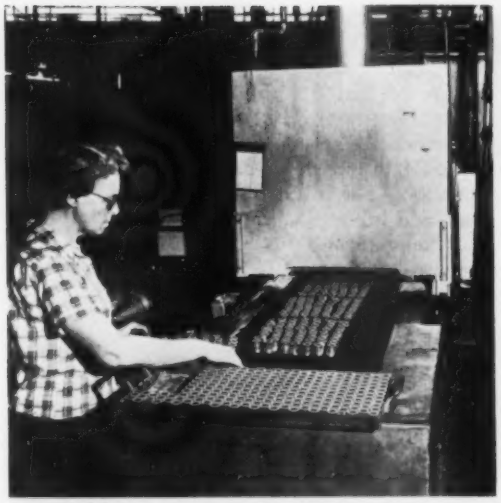
HERE IS HOW MAYTAG MAKES SINTERINGS

Strict quality control of both raw materials, semi-finished, and finished products, results in high quality parts with only 0.4% total scrap loss.

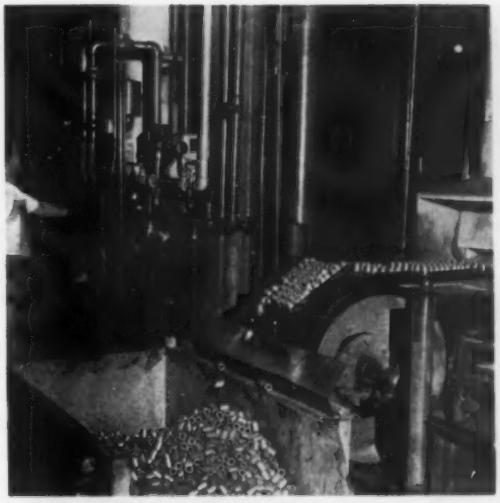
1. WEIGHING IN a powder mix.

2. ROTARY DRUMS mix the powder.

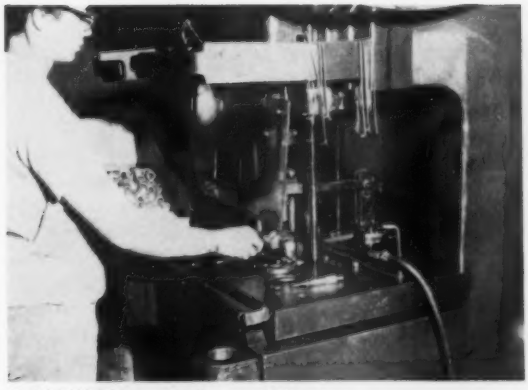
3. COMPACTING on automatic presses.



4. **SINTERING** in a continuous belt type furnace.

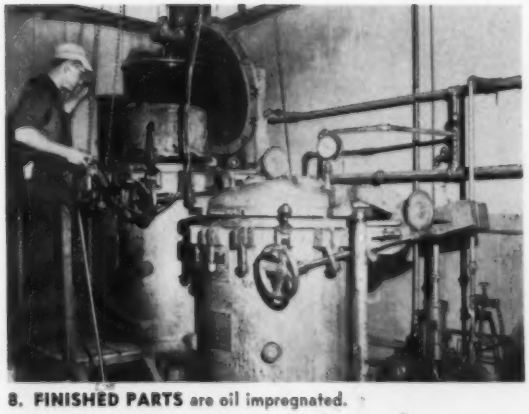


5. **SINTERED** bushings discharge into hoppers.



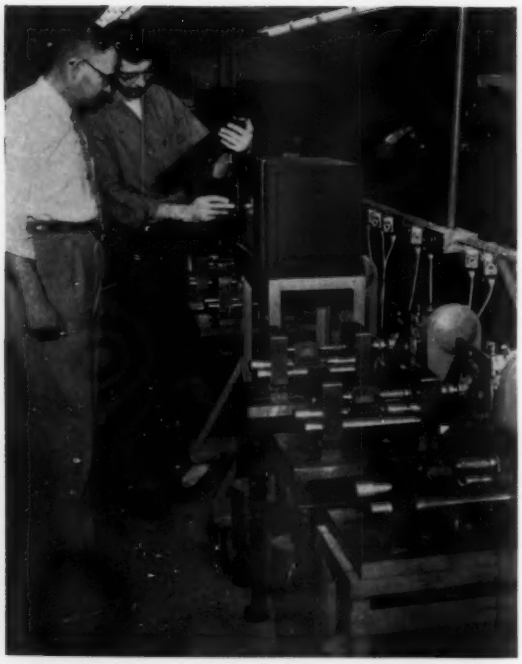
6. **BUSHINGS** are sized on a coining press.

7. **INSPECTION** segregates bushings by size.



8. **FINISHED PARTS** are oil impregnated.

9. **EVEN OVERSIZED** tools are held in stock.



10. LIFE TESTING of bushings is part of the routine quality control program.

The acceptance of the bushings is based upon standard chart information jointly established by laboratory and final inspection. These charts include such items as weights, dimensions and machinability. Strict conformance to the specifications has contributed largely to the success of Maytag's bushing program.

In spite of the care exercised in the manufacture of sinterings, the final test must, of course, be in operation. Maytag has, therefore, developed a bearing testing machine which enables them to run life tests on bushings under actual or excessive load conditions.

Basically, the bearing test gives the same actions you get in a washing machine. That is, spin, oscillation, and slow rotation. Testing is done at 150% or 200% of normal load. Present bushings show a minimum expected life of twenty years.

The bearing test program has done more than just indicate service life of the bushings. For example, it is possible to evaluate lubricating oils used for impregnation. The most desirable viscosity, anti-oxidation and lubricity additives can be determined. It has helped to establish the best material, proper hardness, and surface finish on the shafts running in the bushing.

The testing has also helped in the design and manufacture of bushings which take special treatment. For example, one bushing is subject to high end pressures. Through life testing it was found that this particular unit should be made with higher density at the ends than in the central portion. By making this change the service life was materially increased. In another case, an oil for a bushing was found that did not sludge in service.

Peculiarly enough, tests on oils showed that one of the best lubricants for Maytag use is turbine oil with anti-oxidation and lubricity additives.

Through the entire plant the machine operators and furnace operators are instructed to shut down operations immediately upon noting off-standard parts being produced. With this close control the scrap rate is low. With laboratory sample classed as scrap and even floor sweepings from the mixing room included, the overall scrap rate is only 0.4%. Actual production scrap is only 0.2%.

Because large numbers of bushings of the same size are produced, it has been found economical to use carbide inserts in the dies. Punches are high carbon, high chromium tool steel. Core rods are the same tool steel, but flame-plated with carbide. Normal life, before the carbide bushings go off tolerance, is over 1.5-million pieces and some dies have run 2-million. When a set of tools has gone off tolerance it is not scrapped. There are frequent calls for bushings which are slightly oversize for either repair or maintenance. Generally, these bushings can be made on these worn dies.

Organic finishing zinc and aluminum die casting

From an interview with **P. J. PROVIN,** *Process Control Engineer, Organic Finishing*

THE REASONS for an organic finish on die cast components of laundry equipment are decorative design purposes, protection against the corrosive action of detergents and for corrosion caused where extreme humidity is present.

The same organic coatings are used on both

zinc base and aluminum base die castings. The difference is in the cleaning and in the kind of conversion coating used as a paint base.

Pretreatment of aluminum casting

The die castings are first soaked in an alkaline cleaning solution at 160°F to 170°F. This cleaner is an inhibited type with an emulsion additive.

From the cleaner the parts go through a water rinse and then into the chemical conversion coating. In all cases, Alodine 1200 is used. This is a chromate coating developed by Amchem Products, Inc. Next a thorough water rinse and finally a chromate phosphoric acid rinse is applied. After drying, the parts are ready for organic coating.

Pretreatment of zinc castings

A standard six-stage cleaning and coating line is used for zinc base die castings. There is a first stage cleaner, second stage cleaner, third stage rinse, fourth stage zinc phosphate conversion coating, fifth stage rinse, and sixth stage chromic phosphoric acid rinse.

The castings are then dried and are ready for organic coating.

Organic coating—decorative

All castings made at Maytag receive a two-coat paint job—primer coat and a finish coat. The primer coat may be applied as either hand sprayed or flow-coated.

Where manual coating is used it is usually hot spray. This permits use of a heavier-body paint. The advantages are less tendency for sagging or runs, lower solvent loss with hot spray and less chance of solvent popping and blistering.

The primer coats are of the epoxy type supplied by either DuPont or Glidden.

After flash-off the primer coat is baked at 350°F for thirty minutes, then allowed to cool. This same baking schedule is used for all primer coats regardless of the method of application.

The finish coat is applied by manual hot spray.

The finish coat is a modified melamine type of synthetic finish. Build-up is to a finish or top coat thickness of 1.2 to 1.4 mils. With the hand spray method of application, film thickness is dependent upon the ability of the operator to apply the correct thickness and apply it uniformly. The film thickness on die castings is periodically checked with a Dermitron thickness gauge.

The top coat is allowed to air dry for about 3 minutes and then goes to the baking oven. Cure is at 315°F for 30 minutes.

The total time for finishing parts with a decorative finish would be 3½ hours. This includes cleaning, conversion coating, prime coating, and finish coating.

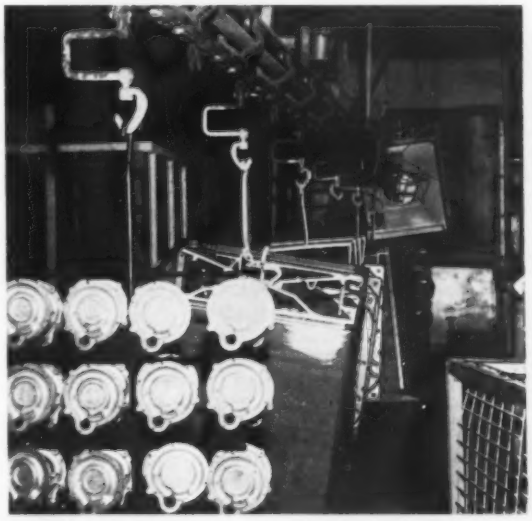
Organic finishings—nondecorative

Many of the die cast parts are not exposed to view, but are exposed to the corrosive action of detergents. On these castings the chemical conversion coating is the same as for decorative paint finishes. The principle change is in the type and thickness of the organic coating. Only a single coat is used and this is an epoxyphenolic type paint applied directly onto the chromate or phosphate coating. Film thickness is 1.5 mils. Drying and curing for this material is 30 minutes at 390°F. A black pigment is added to this paint for the purpose of giving visual evidence of the uniformity and completeness of the paint film.

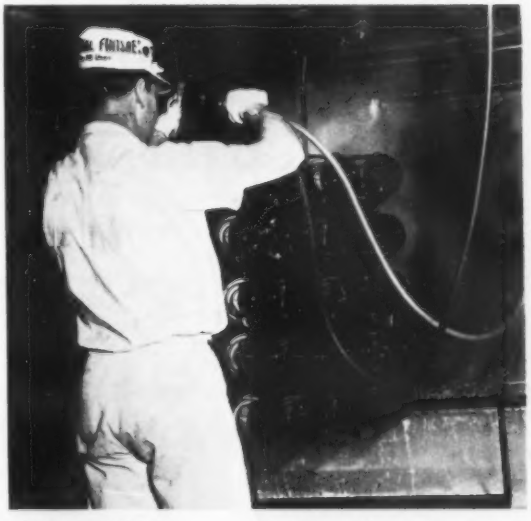
Testing organic coatings

Normally no wear or abrasion tests are used on organic finishes. Control centers around comparative results based upon humidity and detergent resistance. As new materials are available, these finishes are upgraded to provide the maximum corrosion resistance.

For corrosion resistance a standard salt spray or the various detergent tests which are applicable may be used.



PARTS entering the cleaning and coating line.



SPRAY PAINTING non-exposed castings with protective coating.

ALUMINUM die castings are designed, manufactured and fastened as a wall section that is both appealing and withstands the elements.

DIE CAST ARCHITECTURAL SCREEN

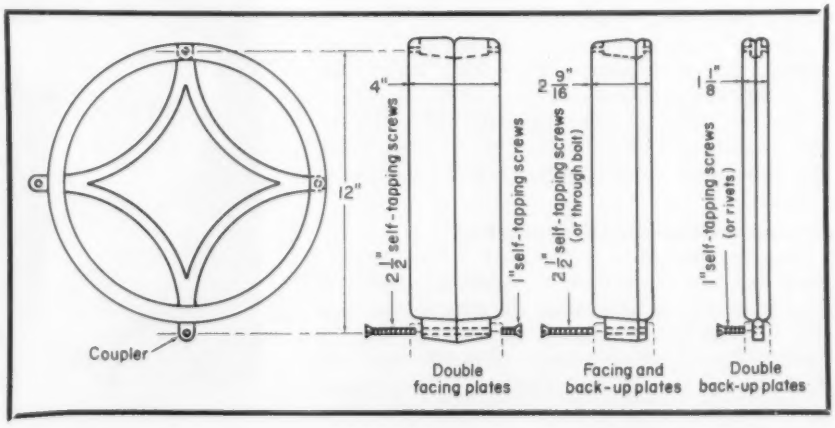
THE SEARCH FOR NEW IDEAS to achieve texture in architectural design has led to the development of Alcoa's die cast Alshade. This new product offers architects a medium for solar and decorative screening at a reasonable price.

Much of the beauty and low price of Alshade is due to the fact that it is die cast. Smooth surfaces, sharp detail, excellent reproducibility, and thin sections readily attainable with die casting contribute greatly to the function and pleasing appearance of the system. Being made of aluminum, the screen holds up well despite continuous outdoor exposure. Also, a die casting can be designed so that the pieces can easily be fastened.

The screen is available in a circular pattern called Shad-O-Wheel. Other patterns are being considered for production. An extruded aluminum frame is offered as an accessory.

Major markets for Alshade are expected to be such uses as refacing older buildings, overlays for lobby walls, vision screens in terraces, gardens and swimming pools areas, and solar screens. This is probably the first use of die castings for this type application.

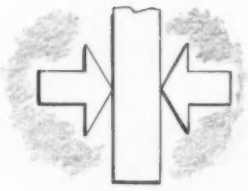
Alshade is offered in eleven colors with a baked enamel finish.



VARIATIONS in Shad-O-Wheel pattern depth are produced by combining facing and back-up plates. These units are arranged in assemblies to make screens from 1-1/8" to 4" deep.

FAST!

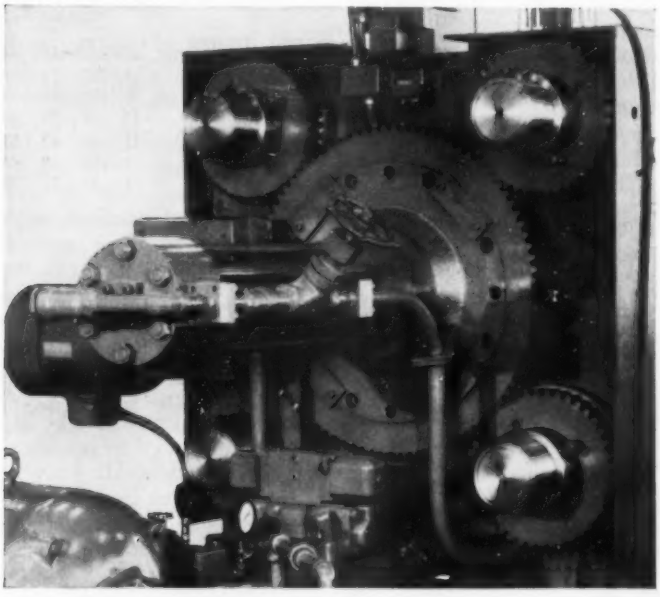
ACCURATE!



STABLE!

EFFORTLESS!

PUSH-BUTTON DIE HEIGHT ADJUSTMENT AND TONNAGE CONTROL... *a valuable operating advantage of Greenlee - B & T Die Casting Machines*



At the touch of a button you can now get die height adjustment for set-up and tonnage control. The Greenlee-B & T system uses a gear-head electric motor to drive a large bull gear which in turn drives a pinion gear on each tie bar nut.

This system maintains . . .

(1) inherent rigidity of our clamp by equal loading of each tie bar and set of four corner links.

(2) large bumper bar pattern, both vertical and horizontal, because there is no central screw interference.

(3) large range of die height adjustment normally available with tie bar nut machines without sacrificing individual nut adjustment.

(4) accessibility of hydraulic ejector mechanism.

Greenlee-B & T motorized die height adjustment permits the flexibility of other designs. In addition it provides easier control and adjustment without sacrificing rigidity. Write for complete information.

PRODUCTION MACHINERY
GREENLEE
B&T

"Don't miss the boat . . . get a B&T quote"

Other Greenlee-B&T Design Advantages

- Four-Corner Link Lock-Up
- Two Stage Variable-Speed Shot Control
- Automatic Press Lubrication and Die Lubrication
- Machine Automation
- Improved Hydraulic Circuit and Welded Flange Connections

B&T MACHINERY COMPANY
A DIVISION OF GREENLEE BROS. & CO.

217 W. EIGHTH ST.
HOLLAND, MICHIGAN
phone EXport 2-2341

TRANSFER MACHINES • SPECIAL MACHINES • AUTOMATIC BAR MACHINES • WOODWORKING MACHINES AND TOOLS • HYDRAULIC TOOLS FOR CRAFTSMEN

Circle No. 9 on Reader Service Card

DESIGN FOR EXTRUSIONS

EXTRUDED MAGNESIUM PELLETS

By R. S. BUSK, *Head, Metallurgical Laboratory, The Dow Metal Products Company*

THE EXTRUSION OF PELLETS of ZK 60 into structural shapes has been a commercial process for over two years. A previous report (PMM, Jan. '61, pg. 35) outlined process and metallurgical information pertaining to the extrusion of these pellets. It was pointed out that the extruded product, known as (P)ZK60B, has the highest strength specifications of any magnesium-base alloy regardless of process or form.

Current commercial product

The current commercial pellet alloy (P)ZK60B is similar in composition to ZK60A, previously the strongest available magnesium-base alloy. These two alloys have specified compositions and mechanical properties as shown in Table I.

TABLE I—Compositions and Mechanical Properties

	Composition		Least Dimension	Cross Sectional Area	Minimum Properties 1000 psi			
	%Zn	%Zr	Inches	Sq. In.	%E	TYS	CYS	TS
ZK60A-F	4.8-6.2	0.45	—	Under 2.0	5	31	27	43
				2—2.9	5	31	26	43
				3—4.9	5	31	25	43
				5—39.9	4	31	20	43
ZK60A-T5				Under 2.0	4	36	30	45
				2—2.9	4	36	28	45
				3—4.9	4	36	25	45
(P)ZK60B-T5	4.8-6.8	0.45 min.	Up to 2.9	Under 20.0	4	35	35	45

The CYS of (P)ZK60B-T5 is superior to either ZK60A-F or ZK60A-T5 for all sizes of extrusions and is itself independent of extrusion size. The tensile properties are at least as high as those for the ingot extrusions and, for the larger extrusions, they are higher. The property differences are due to the fine grain size obtained in extrusions made from pellets.

The compressive yield strength of an extrusion made from ZK60A ingot is lower than the tensile yield strength because the preferred orientation is such as to allow twinning if the extrusion is stressed in compression. The fine grain size of an extrusion made from pellets inhibits twinning with a resultant higher compressive yield strength. This same effect is even more striking if the tensile properties in the transverse directions are considered: (Properties from a rectangular bar 3.5" x 9.5" cross-section, extruded with an 11.4/1 reduction)

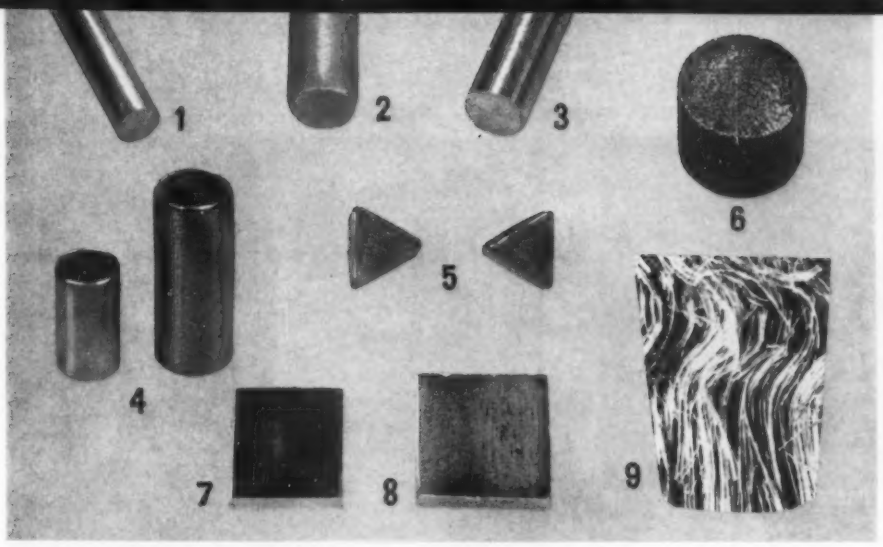
ALLOY	DIRECTION OF TEST	TEMPER	1000 psi %E	TYS	CYS	TS
ZK60A	Longitudinal	F	14	37	24	48
	Long Transverse	F	16	21	22	42
	Short Transverse	F	20	19	20	42
(P)ZK60B	Longitudinal	T5	17	42	42	52
	Long Transverse	T5	8	34	38	46
	Short Transverse	T5	6	30	31	38

The lesser effect of orientation on the yield strength of pellet as compared with ingot extrusion is evident. The elongation of the pellet extrusion is lower in the transverse direction while the reverse trend is true for ingot material. This is due to the physical structure resulting from the extrusion of individual pellets. If no welding occurred between pellets, the elongation might still be finite in the longitudinal direction, but would be zero in either transverse direction. The degree of elongation that can be measured in the transverse direction shows that interparticle welding is very complete. That the amount of working during extrusion affects the transverse elongation of pellet extrusions is well illustrated by the properties of metal from the web of an I-beam.

DIRECTION	TEMPER	1000 psi %E	TYS	CYS	TS
Longitudinal	T5	14	36	35	48
Long Transverse	T5	14	34	35	46

The properties of this more highly-worked extrusion are almost independent of the direction of testing. This effect is also evident if pellet-extruded bar stock is forged. Properties of a rectangular hand forging made from ingot—and from pellet-extruded 6" round billet are:

ALLOY	DIRECTION OF TEST	1000 psi %E	TYS	TS
ZK60A	Longitudinal	16	36	46
	Long Transverse	18	17	39
	Short Transverse	20	17	40
(P)ZK60B	Longitudinal	19	35	48
	Long Transverse	17	27	44
	Short Transverse	4	26	40



CELLULAR MAGNESIUM variations: extruded (1), expanded (2), machined (3), closed die expansions (4, 5, and 6), extruded strip (7), expanded and machined strip (8), magnesium wool (9).

Again, the higher properties for the pellet forging in the transverse directions are ascribable to the finer grain size which acts to inhibit twinning.

Other mechanical properties, such as fatigue, bearing, shear and creep, are about the same for both ZK60A and (P)ZK60B. The corrosion properties are also alike and finishing procedures are the same.

Experimental materials

The Metallurgical Laboratory of the Dow Metal Products Company has experimented with several other types of materials extruded from pellets.

(1) Mg + 6%Zn + 2%MM + 0.5%ZR
(MM = mischmetal)

As discussed earlier, even more effective control of grain size than that provided by alloy gradients can be maintained if a dispersed phase is also introduced. One possibility is the addition of mischmetal to ZK60 to form an alloy with a nominal composition of Mg + 6%Zn + 2%MM + 0.5%Zr. This material has better strength at room and moderately warm temperatures than (P)ZK60B, is weldable, and is less sensitive to exposure to elevated temperature.

Since there are certain production difficulties yet to be solved, this composition has not yet been introduced as a commercial alloy.

(2) Mg + 1%Zn + 0.2Zr + 2%Al

If a pellet alloy containing zirconium is mixed with elemental aluminum and the mixture co-extruded, a composition is produced that can be obtained only by powder metallurgy techniques. As the aluminum diffuses into the matrix, particles of $AlZr_4$ are precipitated resulting in fine grain size and higher properties. Since the structure produced is quite insensitive to temperature, this alloy can be extruded at very high speeds with little or no loss in properties:

(Mg + 0.2%Zr) + (2%Al)

		1000 psi		
EXTRUSION SPEED	%E	TYS	CYS	TS
Low	8	38	36	47
Intermediate	7	40	39	46
High	8	38	37	48

Since this alloy is only now being developed in the laboratory, neither the exact composition limits nor the various shop and service characteristics have been determined.

(3) Cellular Magnesium

A foamed magnesium can be produced by co-extruding pellets with a decomposable compound, so that when the extrusion is heated decomposition takes place, resulting in multitudinous cells. Each particle of the compound therefore becomes the center of a cell and all cells taken together form a very uniform, light-weight foamed structure shown in the illustration. The density can be varied between about 0.6 and 1.0 gms/cc, and, since the cells do not connect, the foamed piece will float in water. Expansion can be done either freely or in a closed die. If the latter, a skin of sound metal surrounds a core of cellular metal and the surface takes the contour of the die surface including any design that it may contain. Cellular magnesium has not yet been introduced as a commercial product.

(4) Magnesium Wool

If no bonding whatsoever were allowed during the extrusion process, each pellet would be expected to elongate individually, an amount determined by the extrusion reduction, resulting in small fibers. This can be accomplished by co-extruding pellets with any one of several materials, producing a "skein" of intermixed fibers with the appearance illustrated as number 9. The length and diameter of each fiber is determined by the diameter of the pellet from which the fiber was produced and the extrusion reduction ratio used. This technique can be used to produce short fibers of uniform dimensions in large quantity.

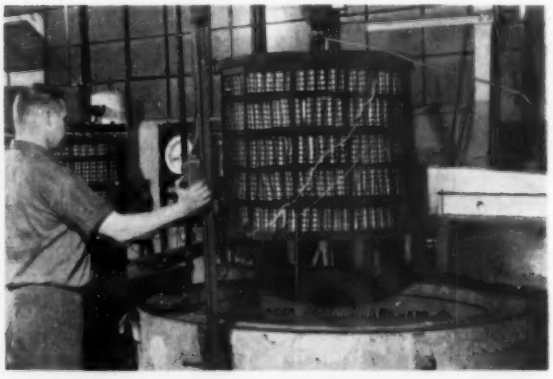
(5) Dispersed Oxides

An extrusion can be produced in any one of a number of ways to have a dispersion of oxide or other inert inorganic material. This can be done by using very finely divided magnesium powder (similar to SAP); by internally oxidizing alloy pellets prior to extrusion; and by simply co-extruding the compound with magnesium or magnesium alloy pellets. While all of these techniques can result in extrusions having improved strength at elevated temperature, the benefits obtained for magnesium by the addition of rare-earth metals or thorium are so large that, contrary to the case for aluminum, no advantage remains to the dispersed-oxide technique.

ALUMINUM round stock is cut into slugs 3″ long on a cut-off saw. The slugs are cleaned and lubricated by dipping them into the tanks behind the saw.

IMPACTING PRESS forces punch down, shaping slug to the die contour as an arm holds another slug ready to be positioned for the next press cycle.

PART is ejected from the die and knocked clear by an arm bringing the next slug into position.



IMPACTED parts are lowered into a furnace for heat treating.

LOW TOOLING COSTS FOR IMPACT EXTRUSIONS

. . . allow wide design use

THE SOUND METAL STRUCTURE and superior mechanical properties produced by the impact extrusion process allow designers to use their materials more efficiently. This, and the ability to form certain complex shapes is helping the process gain wider application.

Tooling costs for the process are low. Often quantities of a few hundred pieces will justify using impacting to rough form your part, even if it still must be completely machined.

Most slugs are impacted at room temperature. This eliminates the need for billet heaters or melting and holding equipment.

These photographs of the installation at the Cliff Mfg. Co. show how impact extrusions are made.

DESIGN FOR
INVESTMENT CASTINGS

". . . . . any geometry which can be investment cast in aluminum can be cast in magnesium as well"

MOST MAGNESIUM ALLOYS CAN BE INVESTMENT CAST

By **KENNETH HERRICK**, *Project Engineer, and*
HARRY MATTHIESON, *Research Director, Arwood Corporation*

THE GREAT STRIDES which have been made in the investment casting of magnesium are not generally known to the design engineer. There have been many problems which have been solved in perfecting production methods to produce high quality castings.

Over the years, research and development work have solved these problems until now, it can be safely said that, any geometry which can be investment cast in aluminum can be cast in magnesium as well.

This research work has shown that there are many alloys which can be investment cast so that the designers choice is no longer limited to AZ92A. The alloys now being cast to government and aircraft specifications are:

Room temperature applications

AZ92A Provides the best combination of tensile yield and ultimate strength.

AZ91C Provides the best combination of tensile yield and ultimate strength, plus good ductility. Lower tendency to porosity than AZ92A.

AZ81A Provides the best ductility, finest grain size.

AM100A Good combination of tensile yield and ultimate strength plus good ductility. Excellent soundness and pressure tightness.

Elevated temperature applications

EZ33A Recommended for service up to 450° to 500°F. Excellent soundness and pressure tightness.

HK31A For service up to 600°F, but tests have shown that for short time applications the alloy may be used at temperatures up to 700°F.

TABLE I—CHEMICAL COMPOSITION

ALLOY	MG	AL	ZN	MN	SI	CU	NI	RARE EARTH	ZR	TH	TOTAL OTHER ELEMENTS MAX.
AZ92A	Rem.	8.3/9.7	1.6/2.4	0.10 Min.	0.30 Max.	0.10 Max.	0.01 Max.				.30
AZ91C	Rem.	8.1/9.3	0.4/1.0	0.13 Min.	0.30 Max.	0.10 Max.	0.01 Max.				.30
AZ81A	Rem.	7.0/8.1	0.4/1.0	0.13 Min.	0.30 Max.	0.10 Max.	0.01 Max.				.30
AM100A	Rem.	9.3/10.7	0.3 Max.	0.10 Min.	0.30 Max.	0.10 Max.	0.01 Max.				.30
EZ33A	Rem.		2.0/3.1			0.10 Max.	0.01 Max.	2.5/4.0	0.5/1.0		.30
HK31A	Rem.		0.3 Max.			0.10 Max.	0.01 Max.		0.5/1.0	2.5/4.0	.30
AZ31	Rem.	2.5/3.5	0.6/1.4	0.20 Min.	0.30 Max.	0.05 Max.	0.005 Max.				.30
M1A	Rem.			1.2 Min.	0.30 Max.	0.05 Max.	0.01 Max.				.30

TABLE II—MECHANICAL PROPERTIES

		MINIMUM			TYPICAL		
ALLOY	TEMPER	TENSILE	YIELD	% ELONG.	TENSILE	YIELD	% ELONG.
AZ92A	F	20,000	10,000	—	25,000	13,000	1.0
	T4	34,000	10,000	6.0	36,000	17,000	6.0
	T5	20,000	11,000	—	26,000	15,000	1.0
	T6	34,000	18,000	—	38,000	22,000	1.0
AZ91C	F	18,000	10,000	—	26,000	13,000	2.0
	T4	34,000	10,000	7.0	36,000	15,000	10.0
	T5	20,000	11,000	2.0	26,000	15,000	2.0
	T6	34,000	16,000	3.0	38,000	18,000	4.0
AZ81A	T4	34,000	10,000	7.0	36,000	16,000	12.0
AM100A	F	20,000	10,000	—	25,000	13,000	1.0
	T4	34,000	10,000	6.0	36,000	15,000	10.0
	T6	34,000	15,000	2.0	38,000	16,000	3.0
	T61	34,000	17,000	—	38,000	20,000	1.0
EZ33A	T5	20,000	14,000	2.0	24,000	17,000	3.0
HK31A	T6	27,000	13,000	4.0	30,000	18,000	6.0
AZ31	F	24,000	8,000	10.0	30,000	10,000	15.0
M1A	F	12,000	4,000	3.0	14,000	4,500	5.0

Dip brazing applications

AZ31 & M1A Recommended for waveguides and other parts which will be used in dip brazed assemblies.

The chemical composition of these alloys is given in Table I and the mechanical properties in Table II.

Some additional comments are needed about the properties listed in Table II. The short time guaranteed tensile and yield strength of EZ33A-T5 and HK31A-T6 at 500°F is 13,000 psi tensile and 8,000 psi yield strength. Typical values are considerably higher. Stress rupture properties of HK31A-T6 have minimum values of 20,000 psi at 400°F for 100 hours and 7,000 psi at 600°F for 100 hours.

Creep is an important consideration in design for elevated temperature operation. Loads may persist over several hundred hours as a result of static weight or dynamic operating conditions, as well as from differential thermal expansion. Over a long period the material deforms gradually until satisfactory functioning is lost. At 400°F a typical creep value at 0.2% total extension for 100 hours would be 1500 psi for the Mg-Al-Zn alloys compared to about 7000 psi for the Mg-Rare Earth-Zn-Zr alloys and about 11,000 psi for Mg-Th-Zr alloys.

The choice of an alloy cannot be made on the basis of operating temperature alone. The limits of stress, time at both peak and normal operating temperature, and allowable deformation determine the specific alloy composition for each application. Experience has proved that the factors of design in many cases are more important than the metallurgical factors. The metallurgical properties can be completely attained only after the best design practices have been fully applied. The few reported service failures are of fatigue origin and have occurred at points where proper design features were not used.

To reach the required metallurgical standards the first step was to perfect melt quality. One major development was the improvement of grain refining technique so that hot cracking and excessive porosity were not problems.

Heat treating cycles, applicable to investment casting, had to be developed. Those in use for sand, die, or permanent mold castings would not give optimum results.

Tests were made on the rate and condition of the solidification of magnesium in the ceramic molds. However, castings with heavy sections often failed to meet standards and rejects ran high. Thermal studies on the solidification of metal in heavy sections were made, and an entirely different method of gating and risering was devised which produced sound metal in such sections.

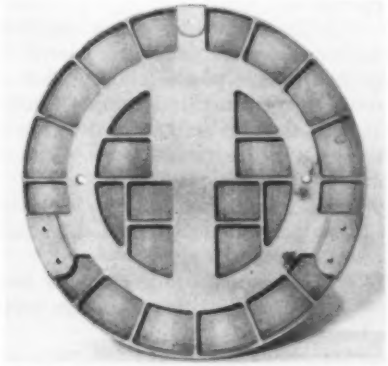
Surface finish was another problem. At one time the finish of magnesium investment castings was considerably rougher than that of other alloys.

New investing and molding techniques improved the metal surface and now magnesium castings have as smooth a finish as other alloys.

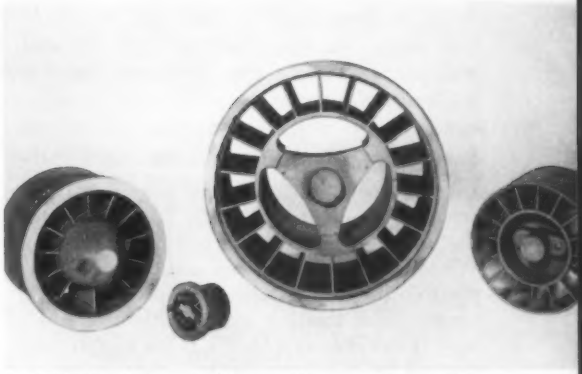
The size problem has been overcome also. Investment castings are made in magnesium in much larger sizes than were previously possible. The average larger part ranges anywhere from two to five pounds and in dimensions up to eight inches, but this by no means represents the limit of the process. In fact, with the new ceramic shell process,

GEAR HOUSING produced in AZ92A, T6 temper. Investment casting of this part resulted in a minimum of machining. Parts are subjected to 100% X-ray inspection to 1A aircraft quality.

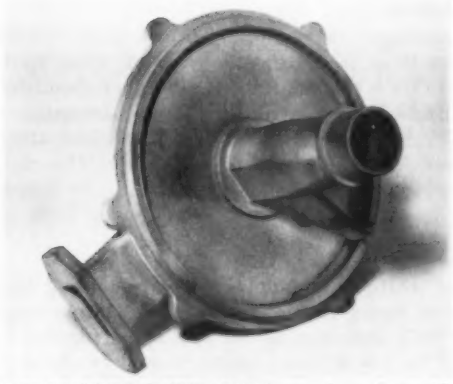
ELECTRONIC WAVE GUIDE horn casting used on the Hawk missile. The part was made pressure tight by using AM100A alloy.



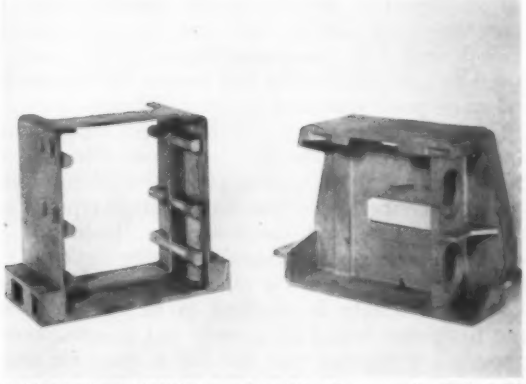
ELECTRONIC mounting plate used on the Jupiter and Redstone missiles. Outside contour is cast to size for assembly on an inside wall of the missiles. Alloy used was AZ91C.



A SERIES of four turbine castings used on fluid metering devices for jet fuels. Size ranges from one-inch diameter with 0.030 inch wall vanes to six-inch diameter with 0.050 inch wall vanes. Alloys specified include HK31A, EZ33A and AZ92A.



ELECTRONIC WAVE GUIDE used on the guidance system of the Bomarc missile. The transition shape of the internal core is held to very close tolerances utilizing any of the Mg-Al-Zn alloys.



HOUSING CASTINGS produced by the ceramic shell mold process. The shell process makes possible more economic production of parts previously deemed too large for investment casting.

magnesium parts weighing thirteen pounds, 12 inches in diameter and 12 inches high are made.

While no standard procedure for the investment casting of all parts can be established, methods of production have been set for general types of parts that have to be cast—large, small, combination of light and heavy sections, and intricately cored parts.

The accompanying illustrations show some of the magnesium castings now being produced at the Arwood plant in Groton, Conn. As with any other metal, good basic design characteristics apply to magnesium investment castings.

HEAT TREATMENT OF CAST

By W. P. James, *WaiMet Alloys Co.*

This paper is part of the Investment Casting Institute Intra-Industry Research Program. Part I of the series appeared in the December, 1960 issue of PMM followed in January, 1961 PMM by Part II. In the first two parts, the heat treatment of 410 and 17-4PH stainless steel alloys was discussed. This report, Part III, concludes the series.

Semi-austenitic stainless—AM-355

Interest in AM-355 for cast parts has been growing steadily although very little has been attempted in the form of investment castings. Current work at WaiMet Alloys Company indicates that it may be possible to develop attractive properties with a very simple heat treating cycle. Although AM-350 is as readily castable as AM-355, it has largely been supplemented by the latter, with higher carbon and lower chromium, except for sheet and strip applications. The heat treatments for the two alloys are essentially the same.

The semi-austenitic precipitation-hardenable stainless steels are austenitic as annealed, and are usually machined in this condition. The composition is carefully balanced to allow a partial transformation to martensite upon suitable heat treatment, refrigeration, or cold work. The transformation treatments are followed by aging treatments that temper the martensite and cause precipitation of hardening phases.

These alloys develop the highest room temperature tensile strengths of the stainless types discussed in these reports, but the ratio of yield strength to tensile strength may be lower than for the other types. Corrosion resistance and stress-corrosion resistance at high strength levels are generally excellent up to about 900°F, and better than the other hardenable stainless alloys. Weldability is excellent in all conditions of heat treatment. Based upon creep and stress-ruptured properties it appears that AM-355 is good for long-time applications to at least 700°F and for short-time applications to at least 900°F.

By proper choice of heat treatment, AM-355 can be made to resemble an austenitic stainless steel such as Type 302 or a martensitic stainless such as Type 410. This is because all the elements in AM-355 contribute to austenite stability, the most effective being carbon and nitrogen. On cooling from a truly austenitic condition the martensite transformation does not start until well below room temperature. When martensite does form it is strong and hard because of the carbon and alloy content, subsequently requiring only tempering to desired properties, similar to Type 410. There is undoubtedly additional strengthening due to precipitation of alloy phases during the tempering operation.

Complete annealing is accomplished by heating to a temperature of 1900°F or above, forming a homogeneous single phase solid solution alloy. Cooling to room temperature retains this condition and the alloy can then be cold formed or machined. This high temperature treatment is not recommended for castings for two reasons:

- It results in a coarse austenitic grain size which cannot be refined by subsequent heat treatment.
- The response to subsequent hardening is decreased, resulting in poorer properties.

Conditioning

Annealing in the range of 1200-1800°F causes chromium carbides to precipitate, thereby decreasing the austenite stability.

Holding 1650-1750°F for a few minutes will increase the temperature for the start of martensite formation to slightly above room temperature.

Hardening

Hardening is accomplished at this point by cooling at −100°F or lower for three hours, then warming in air to room temperature. With proper chemistry the structure will be nearly completely martensitic, with 0 to 5% delta ferrite and 5 to 20% retained austenite uniformly dispersed in the martensite. The residual retained austenite is stable and will not transform upon heating and cooling, even under high stress.

Tempering

Heat treatment is completed by tempering for two to three hours in the usual temperature range of 850-1000°F, followed by air cooling. Tempered hardness at the lower temperatures should be about 47-50 Rockwell C and after 1000°F tempering, about 38-41 Rockwell C. Thus it is possible to do some finish machining after final heat treatment.

Special treatment for machining

If machining is a problem, the preferred treatment is to condition or "equalize" the structure by heating at 1375-1475°F for 3 hours and air cooling to room temperature. Overaging at 1050-1100°F for 3 hours and air cooling produces a uniform hardness of about 35 Rockwell C, suitable for rough machining. This would normally be followed by annealing at 1650-

1750°F, sub-zero cooling, and tempering to desired properties at 850-1000°F.

Chemistry control

Control of chemistry is critical as to C and N contents only. Each of these elements must be held within rather narrow ranges. The important factor is the total of C plus N. The optimum value appears to be in the range of .19-.21%. When C + N reaches .24%, response to heat treatment becomes erratic. At a total of .25% and higher, ductility drops off quite rapidly.

Segregation of heavy elements can occur, especially when the chemistry is unbalanced. Such segregation forms patches of retained austenite which can to some extent be lessened by carbide conditioning treatments prior to full hardening and tempering. High pouring temperatures and slow cooling rates will increase the amount of delta ferrite, but its effects in this alloy are not yet well understood.

Current investigations

Since practically no work had been done on AM-355 in the form of investment castings, WaiMet Alloys Company initiated a development program in the latter part of 1958, working in conjunction with Allegheny Ludlum Steel Corporation. Current efforts are directed toward development of the optimum heat treat cycle for investment cast parts.

In the as-cast condition the alloy should be mostly austenitic with considerable carbide precipitation due to the slow rate of cooling. It was felt that this structure could be equalized or conditioned for full hardening without re-austenitizing at 1900°F. Accordingly, a number of cast tensile bars were prepared and conditioned at 1375°F for one hour and oil quenched, finish machined, hardened by refrigeration, and tempered. Some bars were tempered directly from the conditioning treatment. Table I gives the results of these tests. Heat 30-69 in Table I lists the results of an acceptance test on a separate production heat, following a full heat treat cycle as prescribed by North American Aviation, Inc. Specification No. LB 0160-106.

Preliminary results

These tests indicate the attractive possibility that good tensile properties can be developed merely by equalizing, hardening, and tempering the cast structure of AM-355. Furthermore, the refrigeration treatment may not always be necessary. Structural stability and degree of corrosion resistance in this condition are probably not as good as in the fully heat treated state. These factors require more complete evaluation.

It is obvious that very good properties can be obtained by a more complete cycle, as given for treatment D in Table I, without as high a temperature as required for 17-4PH. In fact, there is no necessity for atmosphere control at any state of heat treatment for AM-355. The refrigeration cycle can be accomplished quite readily with a mixture of dry ice and acetone.

These tests also show considerable loss in ductility at high strength levels when the total of carbon plus nitrogen is too high. Since there are adequate working ranges for each element, the chemistry of remelt stock can easily be adjusted to avoid this difficulty.

More information is needed concerning the transformation behavior of this alloy. Our studies of heat treating cycles best suited for investment castings are continuing, with emphasis toward elimination of any high temperature treatment in the complete cycle.

TABLE I PROPERTIES OF INVESTMENT CAST AM-355 ALLOY

Heat No.	Heat Treatment	Tempering Temp., °F.	Tensile Strength, Ksi.	.2% Yield Strength, Ksi.	Elong., % in 1"	Red. of Area, 1%
30-58	A	875	194	139	2.5	23.3
	A	900	198	154	4.0	7.0
	A	1075	147	121	12.0	29.5
	A	1150	143	115	10.0	31.9
30-59	A	875	195	158	10.0	26.9
	B	875	199	160	12.0	22.5
	C	875	196	158	10.0	25.4
	A	900	190	160	6.0	15.2
	A	1075	148	123	13.0	42.0
	A	1150	143	117	14.0	47.5
30-69	D	850	205	172	6.5	19.7

HEAT TREAT KEY
A = 1375°F – 1 hr. – oil; – 100°F. – 2½ hrs. – air; temper as indicated – 1 hr. – air.
B = 1375°F. – 1 hr. – oil; – 85°F. – 2 hrs. – air; 875°F. – 1 hr. – air.
C = 1375°F. – 1 hr. – oil; 875°F. – 1 hr. air.
D = 1850°F. – 1 hr. – air; 1710°F. – 1 hr. – air; – 100°F. – 3 hrs. – air; 850°F. – 3 hrs. – air.

COMPOSITION OF REMELT STOCK, PER CENT

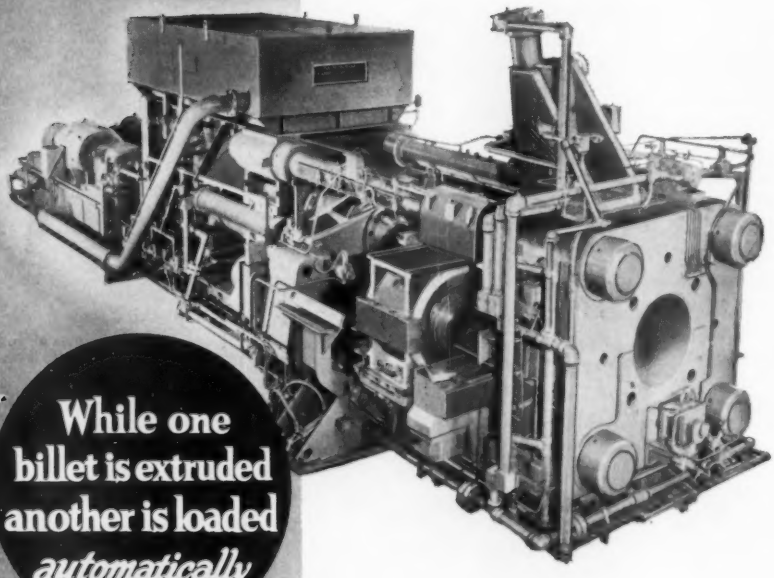
Heat No.	C	Mn	Si	P	S	Ni	Cr	Mo	N	Fe	C + N
30-58	.11	.61	.45	.010	.021	4.48	15.03	2.23	.13	bal.	.24
30-59	.11	.48	.53	.007	.016	4.34	14.55	2.23	.09	bal.	.20
30-69	.11	.66	.23	.006	.015	4.29	15.77	2.57	.08	bal.	.19

Dead Cycle Time Virtually Eliminated

by "YOUNGSTOWN"

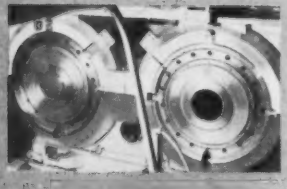
Presses

with Dual Containers*, Double Die Slide*, Rapid "Rotac" Shear*



While one billet is extruded another is loaded *automatically*

with DUAL CONTAINERS



ALUMINUM · COPPER · BRASS

Flexibility of Die Slide Design permits easy adaptability for extrusion of copper and brass. Auxiliary components enable operator to eject "skulls" from container and to load billets while billets are being extruded.

Double tooling permits cooling without detracting from cycle time.

Properly cooled dies permit higher extrusion speeds. It reduces pickup and produces the ultimate in surface quality.

"Rotac" shears in approximately 2 seconds —¼ the time of conventional butt shear.

Whether your need is for a complete extrusion plant, a new press, auxiliary equipment, or revamping of present equipment, it will pay you to consult a "Y F & M" extrusion engineer.

*Patent Applied For.

The Youngstown Foundry & Machine Co.

Youngstown 1, Ohio

Circle No. 54 on Reader Service Card

X-11

PLASTIC

A NEW TECHNIQUE, developed by a tool and die maker, may be a big money saver for both the user and the producer of die castings.

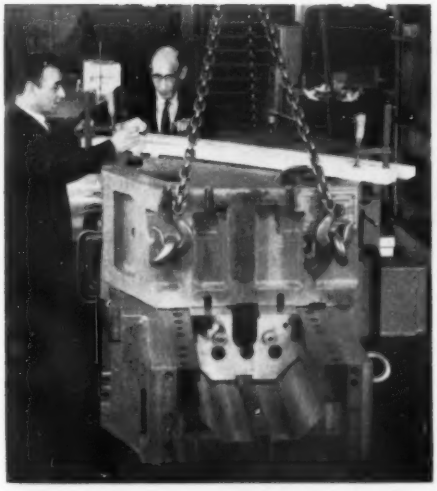
When a set of tools for making die castings are finished the die maker ships them to the producer's plant. They are put into a die casting machine and the foundry makes trial runs. The die caster inspects the castings from these trial runs and sends some to the buyer for his OK before production can start. All this is expensive, but if there's an error, or if some change has to be made, the dies must go back to the tool shop for further work. Time is lost and there are heavy transportation charges, particularly on very large dies.

Bobinchuck Machine & Tool Co. has adapted a pattern-makers trick. After completing a set of tools they inject a special plastic into the closed dies. This plastic sets up without any dimensional changes. When completely cured it can be removed from the die. Dimensions can be checked on the plastic casting while the original tools are still in the shop.

Here's a typical procedure Bobinchuck uses to produce the large transmission housing casting shown in figure 3.

- Clean the dies thoroughly to remove all dirt, oil, grease, and finger prints.
- Apply a thin coat of Johnson's paste wax over all die surfaces. This must include all cores and slides. Polish all waxed surfaces.
- Spray on a parting agent. The one now being used is No. 250-A Vinyl Parting Agent sup-

CASTING FOR CHECKING DIE CASTING DIES



THE CLOSED DIE with any slides and all cores in casting position is filled with special plastic.

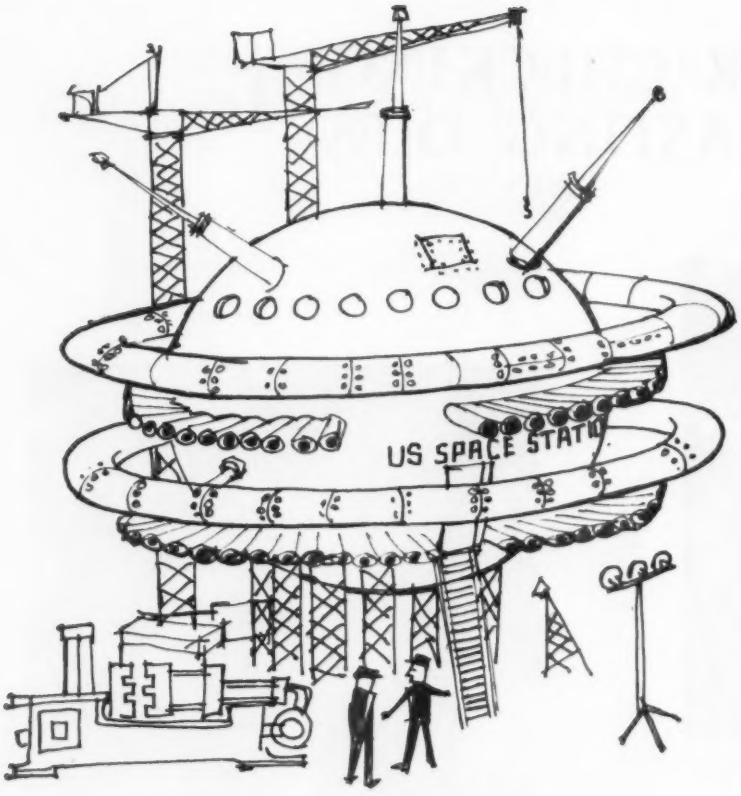
THE PLASTIC CASTING, still in the ejector half of the die, ready to pull the slides and eject the casting with the tooling ejector system.

A FINISHED PLASTIC CASTING set up on a surface plate ready for dimensional checking.

plied by Kish Resin, Inc. of Lansing, Mich.

- Allow the parting agent to dry thoroughly, then apply a second coat of Johnson's wax. This coat is not polished out.
- For making the casting use U.S. Gypsum's Epoxical Thick Section Casting Resin. As supplied, the resin needs to be mixed with a catalyst. After the mix is made, brush a layer over all of the die surfaces and allow it to dry.
- Now mix a small amount of the catalyzed material with enough floc to form a putty. Force this into, and around, bosses, lugs, flanges, etc. where air might be trapped.
- Assemble the die and plug the shot hole tightly except for

Continued on next page



We can cast it...use Die Slick 606-X!

Here are brand new third generation die casting compounds—Die Slick 606-X for heavy or intricate aluminum castings that tend to run hot, and Die Slick 690 for spotless hardware finish zinc casting. Both formulations have the unusual property of *not* building up on the die. And both compounds provide maximum release properties together with the ability to prevent soldering altogether.

A companion product in Die Slick's new 600 Series is No. 694, the best compound for 3 out of 4 aluminum jobs. Both Die Slick No. 694 and 690 properly diluted, will spray through any gun with ease, including automatic equipment. Write for a trial quantity specifying the metal or alloy you are casting. Also write for new Die Slick Data File.

Die Slick is a registered trademark of G. W. Smith & Sons, Inc.

for 20 years

DIE SLICK

used by die casters everywhere

G. W. SMITH & SONS, INC.,
1703 SPAULDING ROAD, DAYTON 32, OHIO

Circle No. 71 on Reader Service Card

PLASTIC DIES

Continued from page 59

a ¼" pipe for injection of the plastic. Clamp the die halves together tightly and block all cores and slides so that they will remain in casting position. Then fill the cavity with resin through the ¼" pipe. Air pressure at 100 psi is used to force catalyzed plastic into the die. When filling is complete, this will be shown by overflow from the filling pipe. Cap the pipe and let the casting cure for about 24 hours.

• When the casting is completely cured, open the die very carefully; pull any slides and cores and remove the casting from the die by using the ejector system.

You now have an exact duplicate of the part as it will be cast in metal with the difference that there has been no shrinkage due to solidification and thermal contraction.

This plastic casting can now be used to check dimensional accuracy, tolerances, surface finish, flash, and improper die functioning. But remember, apply the proper shrinkage factor to all measurements.

It's expensive, of course, to make these plastic castings. The one illustrated cost about $500. But assume that some modification of the die is needed. It would take several days to mount the dies in a machine, make test castings and, if necessary, remove the dies from the machine.

On top of all this there's the added freight when the dies are shipped back to the tool shop, modified, and then returned. A still further expense is a large die casting machine tied up for several days while the dies are being checked and tested. With downtime on a die casting machine at $12 per hour or more, it doesn't take long to pay for the plastic model.

With these plastic models lead time is shortened. The tools go into production much faster, they're right when they are shipped to the casting plant. It's dollars saved all the way.

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Finishing Section

HOW TO POLISH LONG
EXTRUSIONS—AUTOMATICALLY ..Page 63

CAPACITY

. . . a point of difference
when you buy die castings

You're probably not interested in high-sounding claims about "capacity" . . . and we don't make them. But we know that the capacity **you** want must be a realistic part of your own production and purchasing patterns.

That's why Precision Castings Company is geared to provide your specific die casting capacity with:

facilities — to handle standard or special jobs with established production methods

people — who've been with us a long time and know how to keep your job moving and get it finished on time

single responsibility — with large volume capability that saves you the inconvenience of multiple orders to different shops

engineering — to help you save money by adapting practical modern die casting methods to your design

Of course, capacity is only one of "the four points that make the great difference" when you buy Precision die castings — QUALITY . . . CAPACITY . . . SERVICE . . . and PRICE.

Our main job is to see that you get what you pay for in all these areas, and prove that Precision Castings is your best source for die castings.

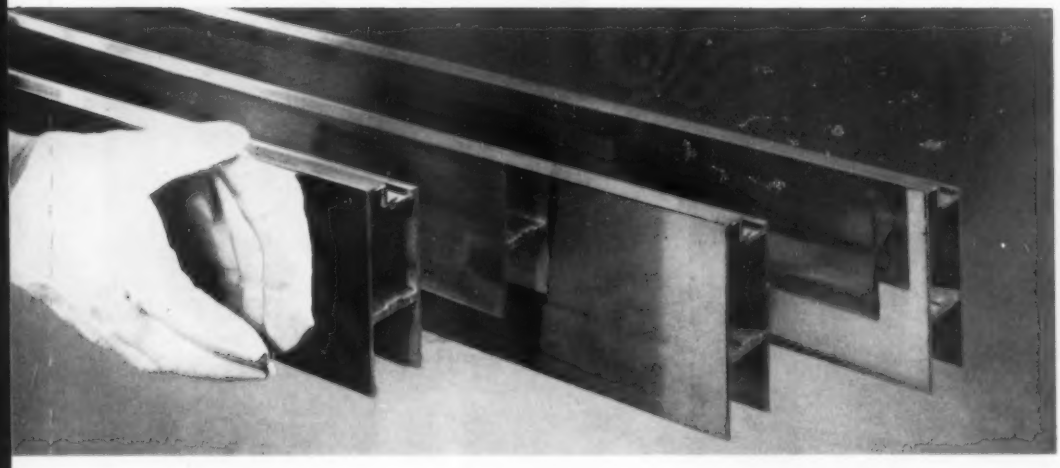
PRECISION CASTINGS COMPANY
DIVISION OF PRECASCO CORPORATION
CLEVELAND, OHIO • FAYETTEVILLE, N. Y.

PRECISION CASTINGS COMPANY
ALUMINUM AND ZINC DIE CASTINGS

***CAPACITY** is corporate strength . . . the dynamic combination of human abilities, manufacturing equipment, financial stability and proper organization that meets production requirements of any volume within the time specified by the buyer.*

Circle No. 75 on Reader Service Card

HOW TO POLISH LONG EXTRUSIONS— AUTOMATICALLY



HIGH LUSTER mirror-like finish is achieved on aluminum extrusions at Allied Enterprises, Inc. by finishing the parts on an automated buffing machine.

FOR APPEARANCE considerations, aluminum extrusions sometimes require a high luster or satin surface finish.

To achieve a high quality surface finish on aluminum extrusions, Allied Enterprises Inc. uses two completely automatic, high production, reciprocating-type, straight line buffing machines built by Acme Manufacturing Company.

Each machine consists of a conveyor on which a reciprocating work holding platen is mounted. Each also has a series of four fully adjustable buffing lathes. Three of the lathes perform buffing operations and the fourth lathe performs a coloring operation.

One machine will handle extrusions up to 21 inches wide and 24 feet long while the other machine will accommodate extrusions up to 10 inches wide and 30 feet long.

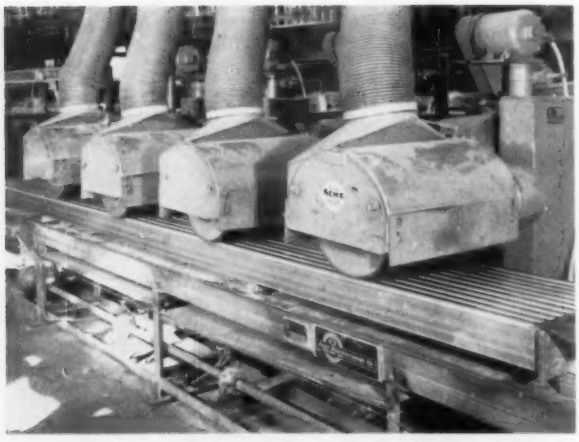
The extrusions finished at Allied vary from approximately 5 feet to 30 feet in length and include a wide variety of shapes.

The size of the extrusion, type of finish desired, type of surface to be finished and the number of extrusions to be processed are all factors that determine the equipment to be used on a particular extruded section.

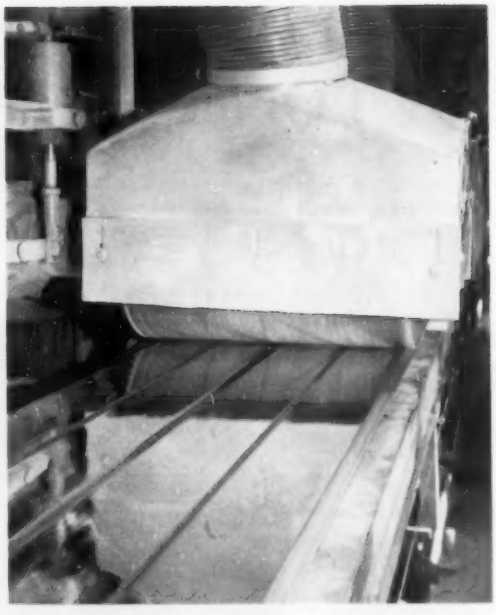
Machine operation

When finishing the 1¾ inch side of 21-foot long, 1¾ by 4-inch rectangular extrusions, five lengths can be run at the same time on the 10-inch wide machine. Five lengths can be finished at the same time on the 21-inch wide machine when finishing the 4-inch side. Conveyor speed on both machines is approximately 30 feet per minute.

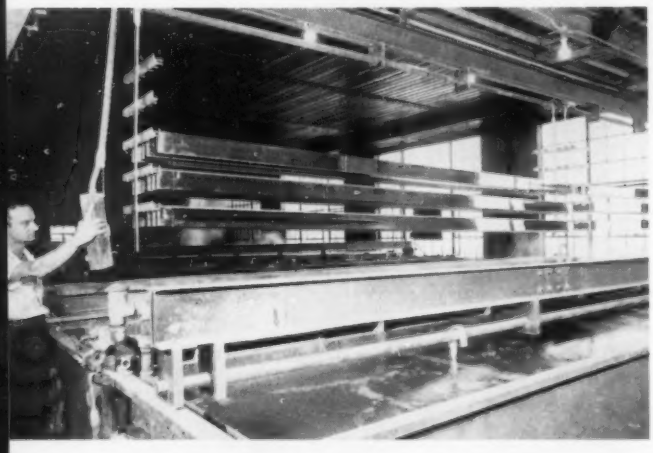
In operation, extrusions are loaded and clamped on the work holding platen of the machines. At the start of the cycle three buffing wheels automatically drop into position and the extrusions are carried under the wheels. The wheels rotate in a direction opposite to the movement of the extrusions. As the extrusions approach the first buffing wheel, a limit switch is tripped which starts an automatic buffing compound applicator. A timer control permits intermittent spray application of a buffing compound at pre-set times or in a continuous operation. The machine operator also manually applies buffing compound to two of the buffing wheels during the initial pass of the extrusions. When the extrusions have passed the last buffing wheel a limit switch is tripped which reverses the direction of the platen.



ELEVEN extruded door styles are buffed simultaneously. This particular machine will handle extrusions up to 10 inches wide and 30 feet long.



EXTRUDED door styles receive a fine finish, four at a time on this 21-inch automated buffing machine. Pieces 24 feet long can be buffed.



ANODIZING the extruded parts after buffing provides protection against corrosion and abrasion. High luster remains good to add sales appeal to the final assembled door.

On the reversing stroke of the platen, a fourth head or final coloring wheel drops into position. The extrusions return under the three buffing wheels and the coloring wheel now rotates in the same direction as the movement of the extrusions. During this reversing stroke, a special coloring compound is used only on the coloring wheel. At the end of the return stroke the platen automatically stops and the extrusions are turned to a different side. Then they proceed through the same cycle.

After all sides have been finished the extrusions are anodized to the customer's specification for surface protection against corrosion and abrasion.

Equipment

The reciprocating platens of the machines are actuated by a motor driven worm gear and rack and pinion arrangement. The platen has an adjustable stroke mechanism actuated by a reversing controller and two limit switches, which can be adjusted for any extrusion length.

Platen speed can be varied through a 3 to 1 variable speed drive having a range of 15 to 45 feet per minute.

The adjustable lathes used on the machine are equipped with a standard air lift arrangement and interchangeable motorized drive units for automatic buffing wheel wear compensation. This maintains correct buffing pressures. Buffing wheel pressures are controlled by the machine operator through a push button control and ampere gauges. Electrical controls for the machine are enclosed in a separate control panel.

Each lathe on the 10-inch machine is powered by a 10 hp motor and the lathes used on the 21 inch machine are each powered by a 25 hp motor.

The machines are adaptable for either buffing or polishing operations or a combination of both. Some extrusions require only an abrasive polishing operation to give a satin finish effect. An abrasive belt arm attachment or buffs, impregnated and coated with abrasive compounds, can be used.

Some extrusions finished on these machines are small in size and have insufficient strength to be self supporting. These types require fixturing on an auxiliary platen that is readily installed or removed.

1 2 3 4 5 6 7 8 9 count to 10

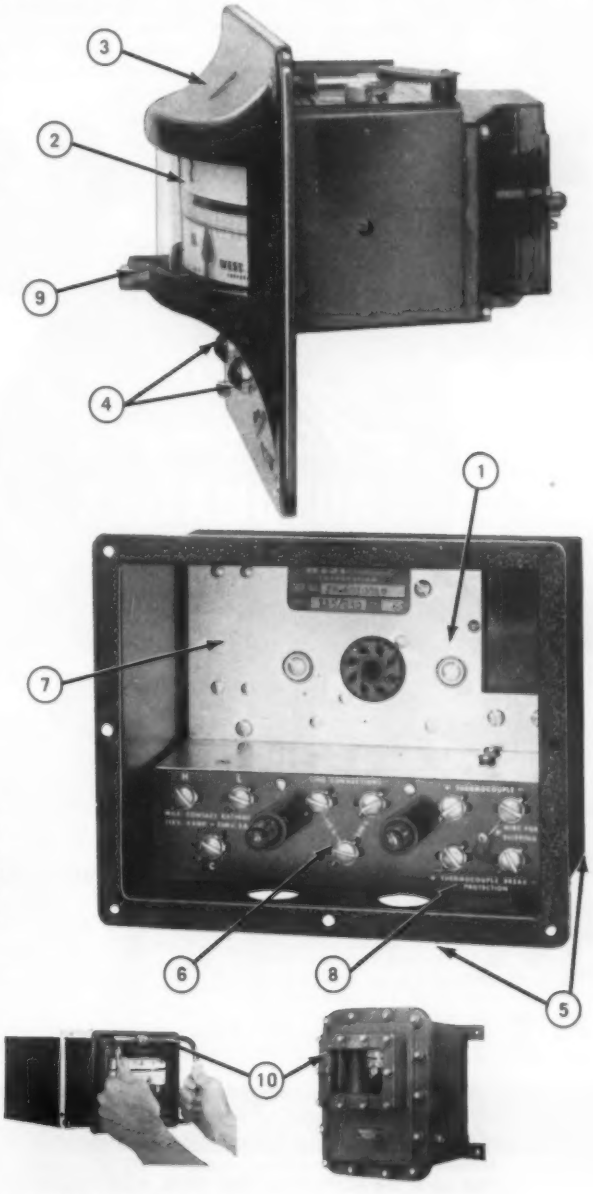
...and keep your temperature under control

ARE YOU GETTING ALL "BIG 10" ADVANTAGES IN YOUR TEMPERATURE CONTROLLERS?

(Use this check-list)

1. **No vacuum tubes**
   Solid-state. Free from warm-up, tuning and complicated circuitry.
2. **Full-time true temperature indication**
   Indicated on mirrored anti-parallax scale.
3. **Sealed plug-in meter unit**
   Dustproof. No special shipping case required.
4. **Two pilot lights**
   Indicate both heating and cooling.
5. **Compact size: 6¼" H x 7½" W**
   Mount more in less space.
6. **Provisions for optional wiring in every instrument**
   For 120, 240 or 208 volts — 50 or 60 cy. Wired from the front.
7. **Interchangeable control modes**
   Change chassis for off-on, proportioning, etc., control.
8. **Thermocouple break protection**
   In every instrument at no extra charge. Shuts off heat if thermocouple breaks or burns out.
9. **Protected temperature setting knob**
   Guarded against accidental movement.
10. **Optional instrument housings**
    Complete instrument plug-in or explosion housings available.

You get *all* of the "Big 10" advantages with *any* Gardsman controller by West, plus proved reliability and minimum maintenance... all at prices you'll find surprisingly low. Ask your West representative for full information. He's listed in the yellow pages. Or write direct for Bulletin COM.



WEST Instrument CORPORATION
SALES OFFICES IN PRINCIPAL CITIES
FACTORY AND GENERAL OFFICES:
4357D W. MONTROSE, CHICAGO 41, ILL.
BRITISH SUBSIDIARY:
WEST INSTRUMENT, LTD.
52 Regent St., Brighton 1, Sussex

Circle No. 53 on Reader Service Card

news of industry & associations

Continued from page 21

Armour Alliance Industries, Coated Abrasives Division—*John G. Bollardi* has been promoted to manager of customer service.

The Newton-New Haven Co.—*Hilker Co.* has been appointed sales representative in the southeastern territory.

E. F. Houghton & Co.—*Harry Martin,* sales manager of the Detroit division, has retired.

WaiMet Alloys Co.—*George D. Haley* has been appointed supervisor in charge of hard-surfacing rod production.

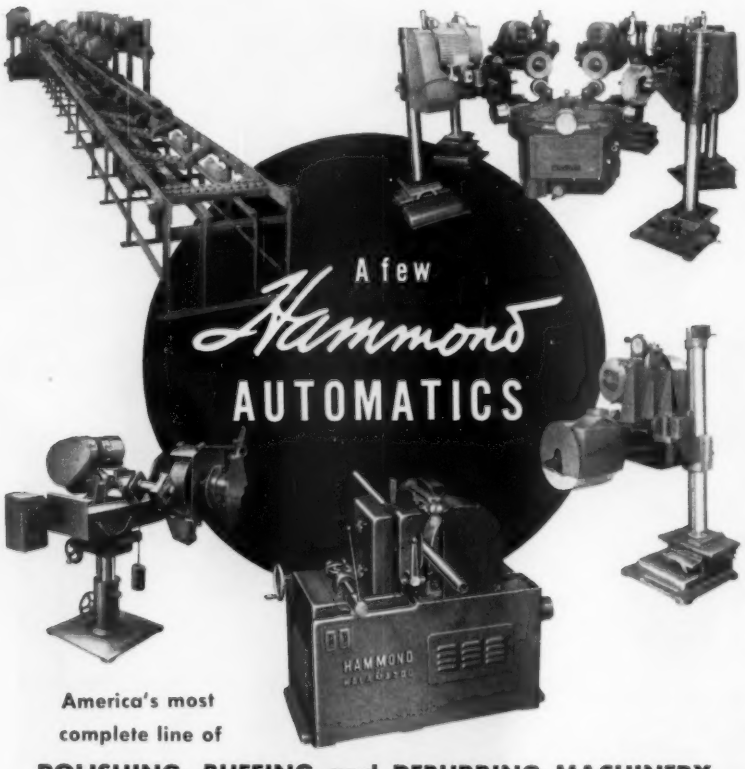
Northwest Chemical Co.—*John V. Brown* is to serve accounts in the northwest Ohio area.

Michigan Abrasive Co.—*Clifford Poole* has been appointed assistant treasurer and assistant secretary.

POOLE

WITT

Precision Castings Co.—*Arthur G. Witt* has been appointed general sales manager of the Cleveland division.



America's most complete line of

POLISHING, BUFFING and DEBURRING MACHINERY

We offer a complete line of Turrets, both indexing and continuous, from 21" to 10' in diameter, and Strait Line conveyors in all styles and almost any length. The right finishing head for the job is available from 1 to 30 HP in floating or rigid types. Junior Automatics, "OD" Cylindrical Finishing Machines, and specials are available for high production finishing of household appliances, brass goods, automotive parts, plumbing supplies, etc. Ask for factory trained engineer to discuss your finishing problems — no obligation.

Hammond Machinery Builders INC.

1642 DOUGLAS AVENUE KALAMAZOO, MICHIGAN

See us at the ATME Show, May 22-26, New York Coliseum

Circle No. 55 on Reader Service Card

Investment Casting Co.—*James F. Roberts Co.* of Indianapolis, Indiana, *C. S. Butler & Associates, Inc.* of Cincinnati, Ohio, and *Marion T. Davis & Co.* of Atlanta, Georgia, have been appointed new sales representatives.

Olin Mathieson Co.—*Gene E. Zinniger* has been appointed executive vice president of Ormet Corp., and *John J. Miller* has been promoted to general manager of Olin's reduction division.

Kaiser Aluminum & Chemical Corp.—*William J. Edmunds* has been appointed general manager of the industrial division. *Stanley B. White* was named vice president manufacturing (aluminum).

Fairmont Aluminum Co.—*Frank A. Guba, Jr.* was named manager of the Miami, Florida branch sales office.

Norton Co.—*Wendell C. Forsman* has been transferred to the New Jersey area as an abrasive engineer. He succeeds *J. Steven Anderson* who retired December 31, 1960.

Tann Corp.—*Albert F. Williams* has been appointed sales representative in the southeastern territory.

Wesson Co.—*Marion Twayne* has joined the sales engineering force serving the midcontinent district.

R. K. LeBlond Machine Tool Co.—*Glenn A. Miller* has been appointed advertising manager.

Hevi-Duty Electric Co.—*Robert M. Palmer* has been named overall field sales manager for the industrial and laboratory furnace and oven divisions.

Advance Pressure Castings Corp.—*Alfred Schneier, Sr.,* formerly president, has been elected chairman of the board.

SCHNEIER

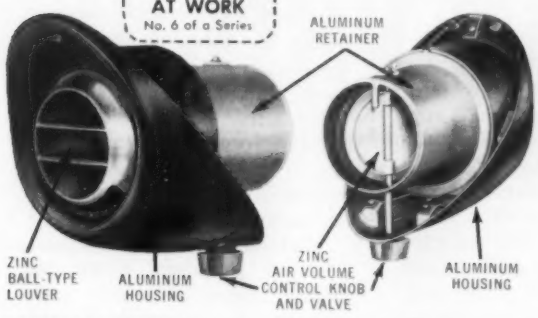
DUNTHORN

Jarl Extrusions, Inc.—*Cyrus D. Dunthorn* has been elected vice president in charge of sales of the East Rochester Company.

more Industry News on page 68

Circle No. 79 on Reader Service Card

PARAMOUNT Die Castings AT WORK
No. 6 of a Series



PARAMOUNT QUALITY... chosen by Shakespeare Products for this automotive air conditioner part

Quality components make quality products. That's why Shakespeare Products Company chose Paramount to make the zinc and aluminum castings for this air conditioner part for a well-known automobile. Paramount *quality* coupled with engineering and production "know-how" are reasons why **it will pay you to look to Paramount.** Investigate Paramount's complete services *now*.

Three complete plants—two in St. Joseph, Mich., one in Seymour, Indiana.

SEND for "Designing for Die Casting"

PARAMOUNT *Die Casting Co.*

(A subsidiary of TALON, INC.) ST. JOSEPH 1, MICHIGAN

Circle No. 40 on Reader Service Card

Ettco
DRILLING and TAPPING

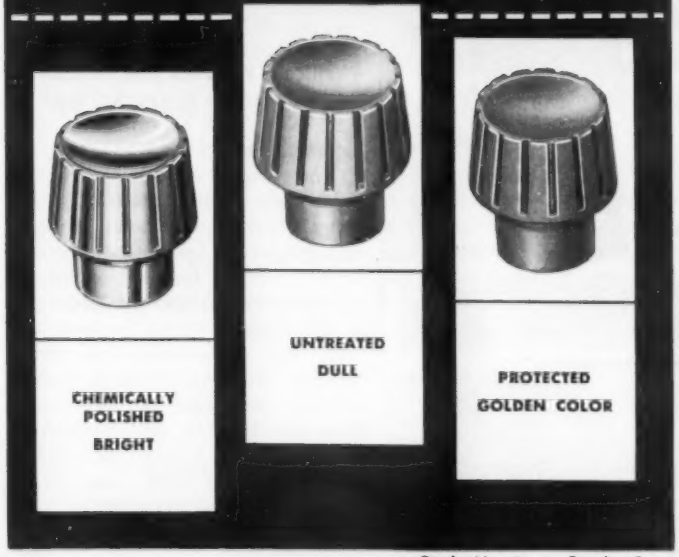
Lead Screw tapping attachments and heads

Here's precision production! Complete uniformity with unskilled labor. The result is speed, accuracy and economy, regardless of quantity.

***Complete Line*-Ettco has the tool for *your* single or multiple small hole production job.**

ETTCO TOOL AND MACHINE CO., Brooklyn 37, N. Y.

DURACOAT®



For chemically polishing, deburring and protecting zinc and aluminum die castings

DURACOAT® DCP-3 and -5. Zinc die cast parts can now be chemically polished by simple immersion. Costly hand or mechanical operations can be eliminated or supplemented with these solutions. Use for reclaiming stripped parts; prior to plating for brighter deposits and increased throwing power into low current density areas, and as a final finish.

CHEMBURR® 3 and 5. For chemically deburring zinc die castings. Eliminates costly mechanical tumbling and hand deburring operations. Internal holes and threaded sections completely deburred and chips removed by simple immersion.

DURACOATS®. Liquid and powdered chromate products for producing bright, irridescent or golden protective finish on zinc die castings. Fast, simple, economical to use. Highest quality at lowest cost.

ALCHROME® #1 and #2. Clear or yellow golden chromate finish for aluminum. Outstanding protection. Can be used to replace anodizing where hardness is not a requirement.

All **DURACOAT®** products meet existing military specifications.

Write for free technical data sheets describing products in detail. Send samples for free processing.

HEATBATH CORPORATION

SPRINGFIELD 1, MASSACHUSETTS

or 701 North Sangamon Street, Chicago 22, Illinois

39 Years of Service to the Heat Treating and Metal Finishing Industry

Circle No. 56 on Reader Service Card

news of industry & associations

Continued from page 21

New sales subsidiary

Arnhold Ceramics, Inc. has formed a new subsidiary company, AC Compacting Presses, Inc. The new company will take over functions formerly carried out by Arnhold's Dorst Division, and will be the exclusive U.S. and Canadian sales and engineering organization for Dorst metal and ceramic powder presses.

Guides and wrappings aid aluminum buyers

Wabash Smelting, Inc. is supplying aluminum buyers with aluminum alloy selectors, on request, and a protective wrapping on packaged ingots.

The aluminum alloy selector is a slide-rule type guide which is especially helpful to the permanent mold and die casting industries. It lists fifty-nine alloys by their common designations and with SAE or ASTM equivalents. The alloys chemical composition is given, plus heat treatment, minimum tensile strength, yield strength, and elongation. Other information includes casting type, thermal treatment, castability and machinability characteristics.

Wabash, according to D. H. Thacker, president, is the first aluminum smelter to offer polyethylene wrappings on its self-palletized aluminum ingots. The plastic completely seals its packaged fifteen and twenty-five pound ingots. Dirt and moisture is kept out which makes it possible to store ingots out-of-doors and for long periods of time with little concern of contamination. Covering is a 1½-mil polyethylene, similar to a dry cleaner's bag, that costs Wabash approximately the same as previously used paper.

Design engineering show opens in Detroit

Reports from automobile company executives on how they measure and meet public tastes in cars will be a feature of the Design Engineering Conference at Cobo Hall, Detroit, May 22 through 25.

The conference and the Design Engineering Show will take place in Detroit for the first time.

The conference is sponsored by the machine design division of the American Society of Mechanical Engineers and the show is produced by Clapp & Poliak, Inc., New York exposition management firm.

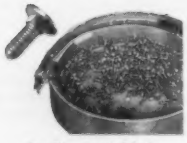
The panel session, which will take place on the first day, will have as participants some of the top engineers and sales executives of Ford, General Motors, Chrysler and American Motors.

The show is one of the largest industrial expositions in the country. Registration cards, conference programs or information about hotels are available from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

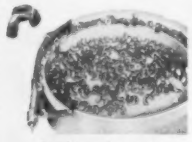
more Industry News on page 70

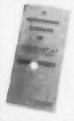
SYNTRON PARTS FEEDERS DO THE WORK OF MANY HANDS
Vertical Vibratory
SYNTRON
PARTS FEEDERS

—speed production, increase efficiency of most operations requiring continuous controlled feeding of small parts.
—flexible enough to handle a wide variety of parts—sizes, shapes materials.
—adaptable to most automatic machines. Supply parts in an oriented, single-line at rheostat controlled rates.
—dependable, powered by the world famous Syntron Electromagnetic drive unit, 3600 vibrations per minute, rheostat control, no mechanical wearing parts to replace or maintain.
—custom built, each feeder is engineered to the specific part that is to be handled.
Investigate the possibilities of Syntron Parts Feeders in your parts handling operation.


Feeding special bolts

Feeding special bass parts


Feeding wing nuts



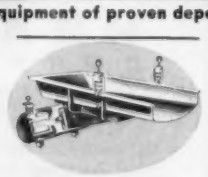
Write today for a Syntron Catalog and complete information about Syntron Parts Feeders.

61PF1

SYNTRON
SYNTRON COMPANY
254 Lexington Avenue • Homer City, Pa.

"Other Syntron equipment of proven dependable quality."

Rectifier Power Units


Vibratory Feeders

Transfer & Storage Parts Feeders

Circle No. 58 on Reader Service Card

Circle No. 22 on Reader Service Card

GRC tiny parts

Die Cast
ZINC ALLOY
Molded
PLASTICS

Die Cast Zinc Alloy

Molded Nylon, Delrin & Other Engineering Thermoplastics

Coil Bobbins

Gears & Pinions

SMALL ZINC ALLOY DIE CASTINGS

Fact-filled booklet contains helpful designer's checklist, exclusive GRC methods to help you create new products at substantial savings.

GRC's unique high speed, automated methods give you high quality, uniformly accurate small parts in die cast zinc alloy or molded Delrin, Nylon and other engineering thermoplastics . . . *at low cost.* GRC experience and exclusive techniques open the way to new design freedom, new production and assembly shortcuts. Write, wire, phone NOW for samples and detailed bulletins. Send prints for prompt quotation.

NO MINIMUM SIZE: Maximum sizes:
Zinc Alloy—1 ¾" long, ½ oz.
Plastic—1¼" long, .03 oz.

GRIES REPRODUCER CORP.

World's Foremost Producer of Small Die Castings
157 Beechwood Avenue, New Rochelle, New York • NEw Rochelle 3-8600

See us at the IRE — Booth #4030

DELAWARE
Machinery *and* Tool Co., *Inc.*

WE DESIGN AND BUILD QUALITY DIE CAST DIES FROM SMALLEST UP TO 20 TONS

EXPERIENCE — Over 20 years experience in designing and building single and multiple cavity, aluminum and zinc die casting dies.

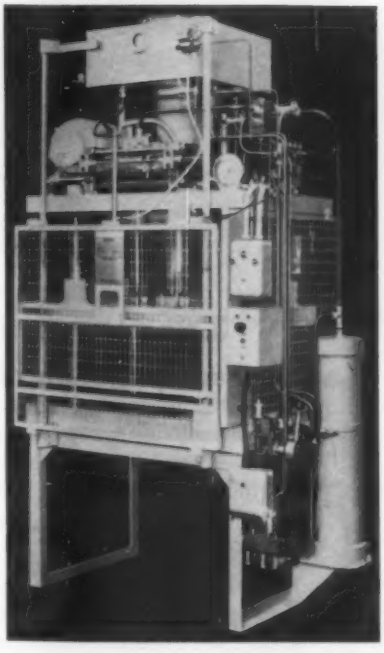
ENGINEERING — Staffed with design engineer specialists in die cast dies and moulds.

CALL OR WRITE TODAY
for our services or complete 8-page brochure of equipment and facilities.

DELAWARE MACHINERY and TOOL CO., INC.
700 South Mulberry Street • Muncie, Indiana
Phone: ATlas 4-3335

Circle No. 19 on Reader Service Card

NEW BIPEL FAST-CYCLE HYDRAULIC TRIM PRESS



A brand new 34-ton clipping press from BIPEL . . . world renowned for their plastic molding presses! This special purpose hydraulic unit offers a faster approach (600 ins./min.), and a fast advance through the work (40 ins./min.), at full tonnage. Dry Cycle Time only 3 seconds. Semi-automatic or manual control . . . with mesh guards for maximum operator safety. A flexible, efficient, clean-trimming unit.

Write for Full Information

B.I.P. Engineering Ltd., Sutton Coldfield, England

RALPH B. SYMONS ASSOCIATES, INC.
3569 MAIN ROAD, TIVERTON, R. I.

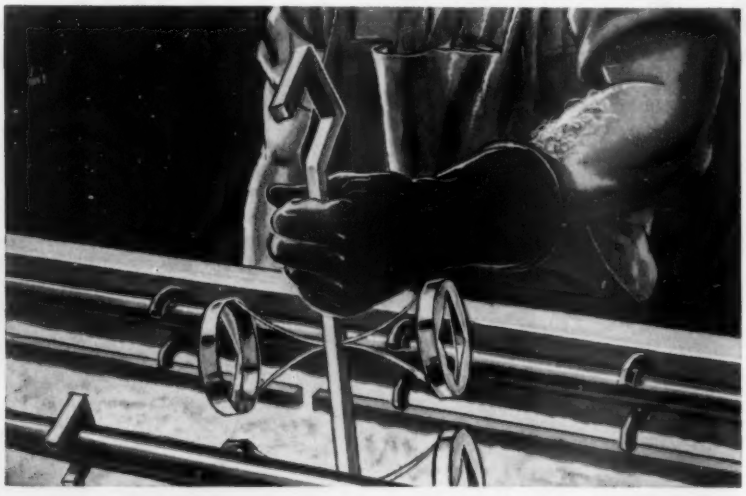
BIPEL®

Circle No. 13 on Reader Service Card

For the best in reverse-current cleaning

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 SERVICE MEN • OVER 160 MATERIALS



3 good reasons why Oakite 90 electrocleaner minimizes plating rejects:

High conductivity, superior smut removal and water-softening ability—there's a trio of good reasons why parts come out of Oakite 90 reverse current baths really ready for electroplating, with no soil nor film to cause subsequent rejection.

(1) High conductivity, of course, puts most of the current to work actually cleaning, instead of dissipating power in overcoming resistance. (2) The superior smut removal stems from Oakite 90's excellent wetting, emulsifying and suspending action that *not only* pries soil off but also prevents redeposition. (3) The water-softening action prevents hard-water scums from forming and clinging to parts as they're drawn from the tank.

Add to these . . . controlled foaming that traps alkaline spray, and exceptionally long solution life . . . still more reasons why Oakite 90 is the "Number One" choice of platers across the country.

Ask the Oakite man to demonstrate Oakite 90, or write for FREE Bulletin. Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask Oakite

OAKITE

over 50 Est. 1909 SCIENCE

years' leadership in industrial cleaning

Circle No. 57 on Reader Service Card

news of industry & associations

New company services die casters

Die Casters' Services, Inc., is a new Ohio corporation. It manufactures and supplies expendable parts and materials to the zinc and aluminum die casting industries in domestic and foreign markets.

KELLEY

The company serves as a district representative for the J. A. Kozma Company on its complete line of furnaces and automatic ladling equipment.

J. B. Kelley, who is both a graduate mechanical and electrical engineer, is president of the company.

Die casting engineers plan Cleveland clinic

The Cleveland chapter of the Society of Die Casting Engineers announced preliminary plans to hold the organization's first large-scale die casting clinic on April 19, 1961 at Cleveland's Carter Hotel.

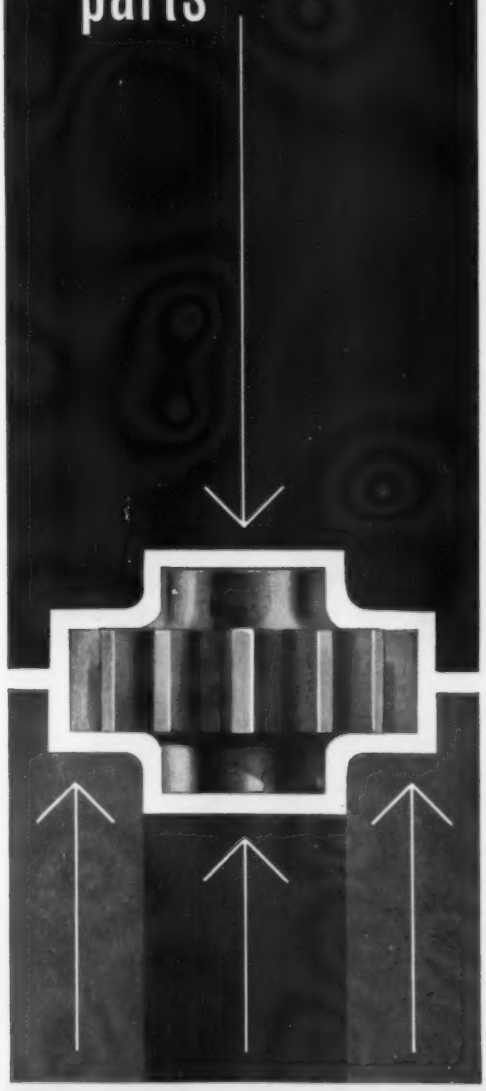
James Drylie, chairman of the local group and die casting engineer at Westinghouse's Cleveland lighting plant, reported that 35 to 40 top die casting producers are expected to participate.

Drylie pointed out that "This gathering will bring several thousand present and potential users of die castings into direct contact with acknowledged casting experts.

"The clinic we plan will have no elaborate booths or displays", Drylie said. "Each participating company will have an area set aside where potential die casting users can discuss production techniques, design features, and cost factors with their top engineering people."

Admission to the clinic will be free to all potential die casting users in Ohio and surrounding areas.

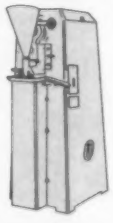
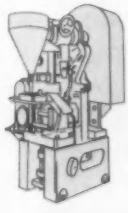
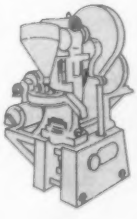
EXTRA MOTION for complex powder metal parts



Stokes answers the growing need for extra motions in the manufacture of more complex parts by adding three *new* machines to its extensive line of compacting presses. In each compacting press, the design of the secondary lower motion enables the operator to adjust timing, duration, and length of thrust independent of the mechanical timing of the preset main operating cycle of the press. The built-in secondary lower motions may be used as compacting punches or core-rods (stationary, movable, stripping, or ejection type).

These low and medium-pressure presses give you all the advantages you would expect to find in a Stokes press . . . accuracy, high production rates, ease of adjustment, and little maintenance . . . *plus extremely flexible lower motions.*

SINGLE-STATION MULTIPLE MOTION PRESSES

Model 572-1	Model 573-1	Model 574-1
4 TONS	12 TONS	20 TONS
		
4 TONS + 1 TON	12 TONS + 3 TONS	20 TONS + 5 TONS

For complete technical data on these single-station multiple motion presses, write for Data Sheet 126. Consult Stokes Engineering Advisory Service for complete technical assistance in designing parts, punches and dies, or complete production facilities.

STOKES

POWDER METAL PRESS DIVISION • **F. J. STOKES CORPORATION** • 5500 TABOR ROAD, PHILADELPHIA 20, PA.

Circle No. 46 on Reader Service Card

All new from KUX

125 TON POWDER COMPACTING PRESS

6" die fill—full 125 tons ejection capacity

MODEL 1100

COMPLETELY AUTOMATIC

125 TONS COMPACTING PRESSURE APPLIED BY UPPER AND LOWER PUNCHES

125 TONS EJECTION PRESSURE

MASSIVE, ALL STEEL MAIN FRAME

RUGGED MECHANICAL TOGGLE OPERATION

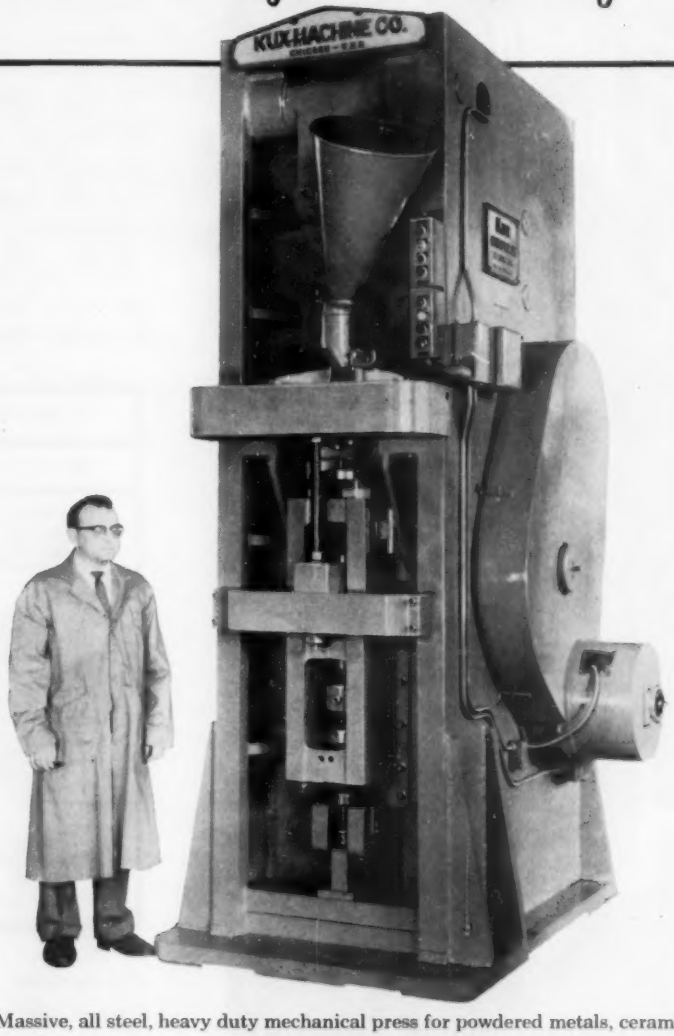
PRECISION PUNCH AND DIE ALIGNMENT

HEAVY DUTY STATIONARY CORE BRACKET

FLOATING CORE ROD WITH TIMING CONTROL

PUSH BUTTON—SINGLE CYCLE OR CONTINUOUS OPERATION CONTROL

SIMPLICITY OF ADJUSTMENTS—NO NEED FOR CAM CHANGES



Massive, all steel, heavy duty mechanical press for powdered metals, ceramics, plastic preforms, tungsten carbides and other powdered or granular materials. An unusual feature of this machine is its capacity to eject a compact with full 125 tons pressure. Both upper and lower punches apply pressure to the part being formed with capacity of up to 6" die fill and the machine is capable of making parts up to 6" diameter or length. Dwell under compression allows compact to set while under pressure. Floating core rod mechanism with up to 4" stroke and moving die table can also be incorporated.

KUX MACHINE CO. • 6725 NORTH RIDGE • CHICAGO 26, ILLINOIS

Circle No. 31 on Reader Service Card

PMM

data offered in this month's ads *qualified readers may obtain any of these free reference materials by circling the numbers on the reader service cards*

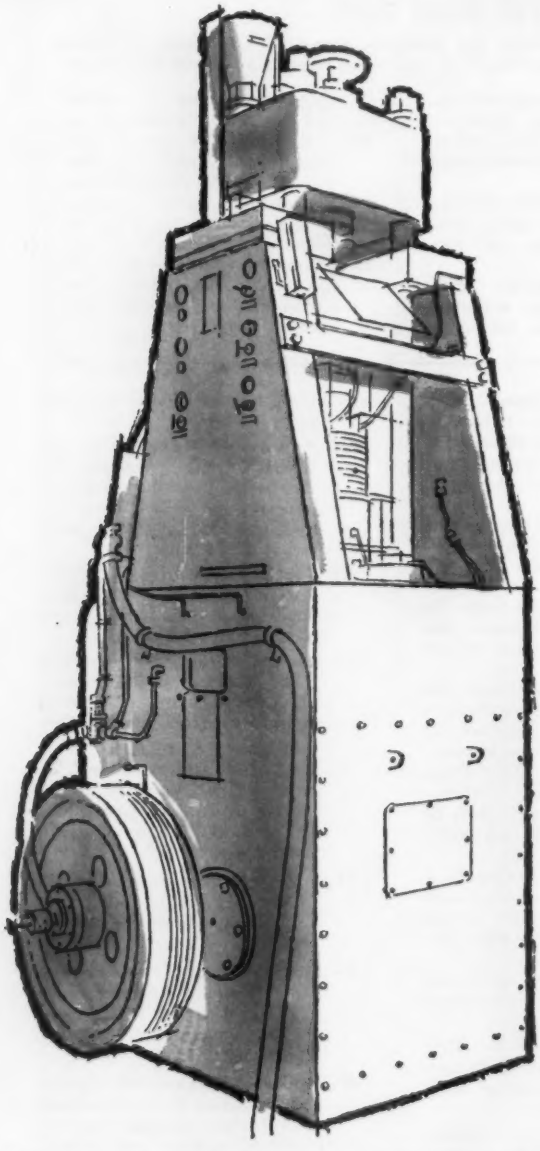
OFFERED FOR THE FIRST TIME . . .

The services and reference materials listed here are being offered for the first time in this issue by new PMM advertisers.

3. **Pneumatic Equipment**—Allen-Air Corp.—88-page Catalog—on a complete line of cylinders, dial feed tables, air valves and pumps.
41. **Extrusion Dies**—PMD Extrusion Die Co.—Descriptive brochure—on precision cast dies for all alloys.
50. **Tool Steels**—Uddeholm Co. of America—Technical information—on tool steels for high-temperature alloy die casting, and for extrusion dies.
54. **Extrusion Presses** — The Youngstown Foundry & Machine Co.—offers extrusion presses and auxiliary equipment for new plants or for revamping the old.
88. **Aluminum Alloys**—Alloys & Chemicals Corp.—offer quality aluminum alloys shipped packaged in polyethylene.

1. **Solid Lubricants**—Acheson Colloids Co.—Technical bulletin—on parting agents and mold coatings for die castings.
2. **Iron Powder**—Alan Wood Steel Co.—Technical information—on custom mixed blends and high-purity iron powders.
8. **Die Casting Alloys**—Apex Smelting Co.—Booklet—describes composition, properties and other data on die casting alloys.
11. **Compacting Presses**—Baldwin-Lima-Hamilton Corp.—Technical data—on compacting presses for large, high density, close tolerance powder metal parts.
13. **Clipping Press.**—B.I.P. Engineering Ltd.—Technical data—on a 34-ton, hydraulic trimming press.
14. **Investment Cast 17-4PH**—Cannon-Muskegon Corp. — ICI technical research report—on the effect of aging time and temperature on investment cast 17-4PH.
15. **Fire-Resistant Hydraulic Fluids**—Celanese Chemicals—Manual—on fire-resistant hydraulic fluids.
16. **Die Casting Machines**—Cleveland Automatic Machine Co.—Catalog—describes the full line of die casting machines.
19. **Dies & Molds**—Delaware Machinery & Tool Co.—8-page Brochure—shows equipment and facilities for making die casting dies.
20. **Standard Unit Dies**—Detroit Mold Engineering Co.—Technical brochure—describes how to lower die costs through standardization.
22. **Zinc Die Castings**—Gries Reproducer Corp.—Booklet—contains helpful designer's check list for automatic die casting of small zinc parts.
23. **Castings**—Hampden Brass & Aluminum Co. — Brochure — shows its facilities for permanent mold and die casting.
24. **Investment Casting**—Hitchiner Manufacturing Co.—Technical information—on the ceramic shell investment casting process.
27. **Fire-Resistant Fluids**—E. F. Houghton & Co.—Detailed booklet—describes a line of fire-resistant fluids.
28. **Die Casting Machines**—H-P-M Div., Koehring Co.—Information—on the Cast-Master Lab Test Program for testing a new product mold on die casting machines.
35. **Die Castings**—Madison-Kipp Corp.—24-page Book—shows designers how to solve die casting problems.
40. **Die Castings**—Paramount Die Casting Co.—Brochure—describes how to design for die casting.
42. **Die Castings**—Premier Die Casting Co.—Facilities brochure—describes complete services including vacuum die casting.
44. **Sinterings**—Reese Metal Products Corp.—16-page Booklet—tells how to cut parts costs by the Remet powdered metal process.
46. **Compacting Presses**—F. J. Stokes Corp.—Data Sheet—on single-station, mutliple motion compacting presses with secondary lower motion.
48. **Pots**—The Tiffin Foundry, Inc.—Brochure—lists a complete line of stock pots.
53. **Temperature Control**—West Instrument Corp.—Bulletin—describes advantages of temperature controllers.
56. **Chemical Finishing**—Heatbath Corp.—Technical data sheets—on chemically polishing, deburring and protecting zinc and aluminum die castings.
57. **Electrocleaner**—Oakite Products, Inc.—Bulletin—describes an electrocleaner used on die castings before electroplating.
58. **Vibratory Feeders**—Syntron Co.—Catalog describes a complete line of vertical vibratory parts feeders.
67. **Powdered Metal**—The New Jersey Zinc Co.—Application and design brochure—tells how to design for pressed brass and nickel silver powdered metal parts.
68. **Tool & Die**—Gentry Carbide Tool & Die Co.—6-page Brochure—describes facilities and carbide tools and dies.
69. **Melting Furnaces**—Warwick Industrial Furnace & Engineering Corp.—Information—on melting furnaces for non-ferrous metals.
71. **Die Casting Compounds**—G. W. Smith & Sons, Inc.—Data file—describes Die Slick compounds for spotless finishes on zinc die castings.
73. **Trim Presses**—Parker-Hannifin Corp.—Bulletin—describes high speed hydraulic trimming presses.
74. **Metal Working Lubricants**—Fiske Brothers Refining Co.—Bulletin—describes methods of working aluminum and aluminum alloys.
80. **Powdered Nickel**—Sherritt Gordon Mines Ltd. — Brochure—includes information on standard, special and coated nickel powders.
81. **Die Casting Machines**—Lester-Phoenix Inc. — Illustrated Bulletin — covers a broad range of die casting machines.
87. **Furnaces**—Brown Boveri Corp.—Literature—Application study—on a complete line of meltdown furnaces.

BIG PARTS, HIGH DENSITY, CLOSE TOLERANCES —all at high production with NEW BALDWIN POWDER METAL PRESSES



New Baldwin Model 200-A powder metal press features enclosed lubrication system and piping. Removable panel at base permits easy access to drive gears and bearings.

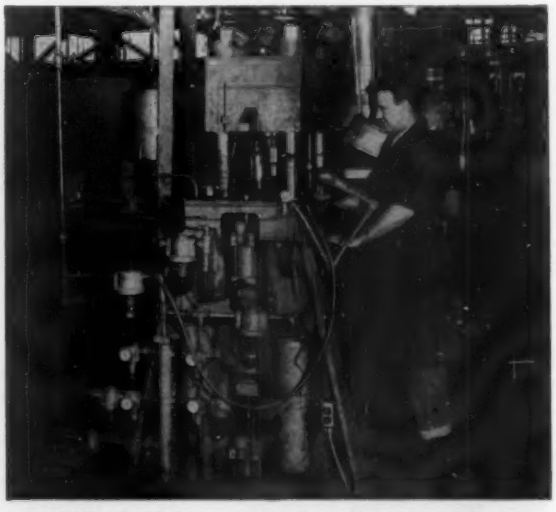
Producing high-tonnage compacting presses is not at all unusual at B-L-H. We build a complete line of mechanical and hydraulic powder metal presses up to 1000-ton capacity.

Proved design and engineering, along with years of manufacturing experience, has made the Baldwin name a standard in the powder metal industry. Die design assistance is also included in our services.

For instance, the popular 200 ton (illustrated) embodies many exclusive Baldwin features:

- Floating die for precision controlled double action
- Four-point guiding for long tool life
- Floating core rod for production of complex shapes
- Enclosed mechanism protects bearings and gears to reduce maintenance cost

Expanded engineering and manufacturing facilities at our Industrial Equipment Division insure even greater service to our customers. For further information, write Dept. CP.



This Model 200-A power metal press at Burgess-Norton Co., Geneva, Ill., has been producing big contacted parts at highest production rates for over 7 months.

BALDWIN · LIMA · HAMILTON

Industrial Equipment Division · Philadelphia 42, Pa.

Circle No. 11 on Reader Service Card

useful literature, catalogs, manuals *qualified readers may obtain*

any of these technical publications by circling the numbers on the reader service cards.

PROCESSES

150 Sinterings—POWDERCRAFT CORP.—Technical Brochure describes specifications for the machine parts and bearings it can sinter. A sample sheet for sintered bronze filters is also available.

MATERIALS & EQUIPMENT

160 Tool Steels—UNIVERSAL CYCLOPS STEEL CORP.—Tool Steel Identifier is a compact slide rule guide for easily finding name, producer, AISI numbers and equivalent brands. A complete AISI tool steel type classification table is shown on the reverse side. Included in this table are AISI designations for water hardening, shock resisting, cold work, hot work, high speed and special purpose tool steels.

161 Spinnings—SPINCRAFT, INC.—Technical Details and engineering drawings on spun-corona rings made by the metal spinning process.

162 Hydraulic Fluid Purifier—MAYHEW PRODUCTS, CO.—Brochure describes full line of portable and stationary fluid reconditioners used to purify die casting machine hydraulic fluids.

163 Lubricants—REYNOLDS METALS CO.—Catalog lists manufacturers of lubricants for aluminum working including hot and cold extruding. Lubricants are listed as to application.

164 Shell Cores—ALBION MALLEABLE IRON CO.—Technical Brochure lists features and process information for making its resin-sand shell cores.

165 Temperature Control—INDUSTRIAL MFG. CORP.—Brochure describes Thermolator, an automatic die temperature controller.

166 Machining Equipment—WISCONSIN DRILL HEAD CO.—Brochure gives technical information on drilling, tapping, boring and reaming equipment.

167 Press Block—DUFF-NORTON JACK DIV.—Information on an adjustable safety press block which supports presses during die servicing operations.

168 Ball Bearing Screw—SAGINAW DIV.—24-page Engineering Data Book on ball bearing screw and spline operation.

169 Trolley Conveyor—RAPISTAN-KEYSTONE, INC.—6-page Brochure describes power and free overhead trolley conveyors.

170 Temperature Controller—ALNOR INSTRUMENTS CO.—Information on a double-target, temperature indicating-controlling pyrometer.

171 Bearing Block—N. A. WOODWORTH CO.—Catalog describes "Zero-Spindle" bearing block assemblies certified to a concentricity of less than 25 millionths T.I.R.

172 Non-Flammable Grease—BEL-RAY CO.—Technical Data on a new grease which will not carbonize, corrode, or melt, and is guaranteed not to burn.

173 Flame Cutting—LINDE CO.—28-page Catalog describes a complete line of Oxweld flame cutting machines, from portable models to large units.

174 Carbide Tools—SINTERCAST DIV.—Technical Reprint describes properties of steel-bonded carbide tools which can be machined to shape and then heat treated.

175 Degreaser—BETA ENGINEERING CO.—Information on an air-cooled vapor unit that assures constant degreasing with distilled solvents.

176 Fluid Reconditioner—MAYHEW PRODUCTS CO.—Brochure describes a unit which reconditions industrial oils and fluids.

177 Melting Pots—POTTSTOWN MACHINE CO.—Brochure lists complete specifications on a line of melting and holding pots with empty weights to 9400 lbs.

178 Motor Control—JOY MFG. CO.—Information on an all-rubber, corrosion proof, weather sealed, push-button motor control.

179 Control Valves—HOFFMAN VALVES, INC.—Bulletin describes a line of mechanically and manually operated control valves.

180 Diamond Products—DIAMOND TOOL RESEARCH CO., INC.—Comprehensive catalog lists specifications and prices for diamond dressing tool and diamond products for industrial applications.

more Useful Literature on next page

GENERAL ELECTRIC does. To produce thousands of these precise "dog pointers" on a lower cost basis they redesigned for powder metallurgy. Instead of a two-part item—which had to be machined, punch pressed, deburred, re-machined and press fit together—one punch of the compacting press at Dixon Sintaloy, Inc. does the job. Each one of the dog pointers pressed from brass powder meets tolerances of ± .001" on the diameter of the .061" hole and has the smooth, dense properties essential for plating. This is accomplished readily by GE to insure that the dog pointer matches the extra-long service life of the kilowatt-hour and other electric meters it is used in.

Think big—think powder metallurgy. For more information about the application, design techniques and properties of metal powder parts, write today to The New Jersey Zinc Company for your copy of "Designing For Pressed Brass and Nickel Silver Metal Powder Parts."

HORSE HEAD® ATOMIZED NONFERROUS METAL POWDERS ARE PRODUCED BY
THE NEW JERSEY ZINC COMPANY
160 FRONT STREET • NEW YORK 38, N. Y.
DEVELOPERS OF BRASS & NICKEL SILVER POWDERS SETTING TODAY'S STANDARDS

Circle No. 67 on Reader Service Card

useful literature, catalogs, manuals

181 **Metal Powders**—FEDERAL-MOGUL DIV.—4-page Brochure on pre-alloyed and elemental powders.

182 **Lubricant**—CHICAGO MFG. & DISTRIBUTING CO.—4-page Brochure describes CMD anti-scoring lubricant, for high pressure applications in machine tool and other manufacturing processes.

183 **Spark Machining**—EASCO PRODUCTS, INC.—Technical Literature tells how to solve your toughest die sinking problems with electrical discharge machining.

FINISHING

190 **Detergent Cleaner**—OAKITE PRODUCTS, INC.—Service Bulletin tells how to use a heavy-duty, strongly alkaline detergent cleaner for removing lubricants and oils from metals.

• **Enameling**—REYNOLDS METALS CO.—8-page Brochure answers questions on porcelain enameling aluminum. It is available on letterhead request from: Reynolds Metals Co., Dept. PRD-41, Richmond 18, Va.

191 **Masks**—CONFORMING MATRIX CORP.—Brochure of advantages gained by using its portable washing machine for cleaning masks used in spray paint decorating.

192 **Plating Conveyors**—HANSON-VAN WINKLE-MUNNING CO.—2-page bulletin on seim-automatic plating conveyor features such as variable speed drives, horizontal agitation, and heavy duty carriers.

193 **Blast Cleaning**—PANGBORN CORP.—8-page brochure describes an abrasive blast cleaning unit which uses controlled centrifugal force for its cleaning power.

194 **Polishing & Buffing**—WYZENBEEK & STAFF INC.—8-page catalog lists a complete line of polishing, buffing, and grinding tools and equipment.

195 **Color Filling**—ACROMARK CO.—2-page article discusses localized color filling and application.

196 **Barrel Finishing**—H. W. DRAMER CO., INC.—Bulletin describes a dry tumbling method which produces a finish similar to hand polishing for deburring and finishing parts.

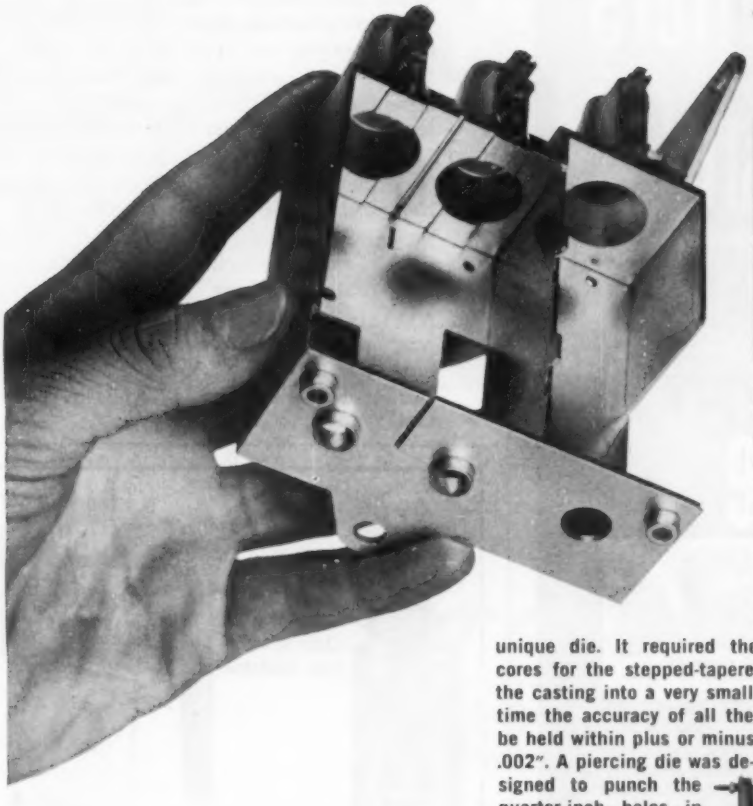
197 **Buffing**—LEA MFG. CO.—16-page booklet on liquid abrasive finishing developments shows systems diagrams and process data.

198 **Diamond Abrasives**—DIAMOND TOOL RESEARCH CO., INC.—Technical Bulletin on the latest advances and techniques in the uses of diamond abrasives.

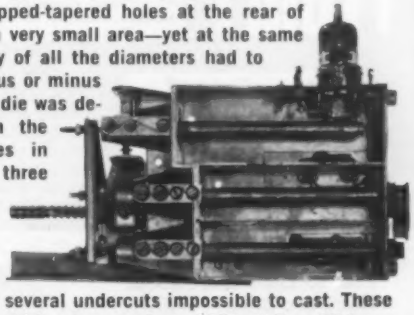
199 **Vinyl Coating**—AMERCOAT CORP.—Bulletin describes a new high build vinyl coating for use with conventional or airless spray equipment.

more Useful Literature on page 78

HOW eLSe WOULD YOU MAKE IT?



■ Supplying this Motorola television tuner housing on a volume basis could have been a real production headache—were it not for the crackerjack combination of a die caster's skill and Zamak. With the performance virtues of these remarkable zinc die casting alloys in mind, Serv-All Tool and Die Company carefully worked up a unique die. It required the withdrawal of three cores for the stepped-tapered holes at the rear of the casting into a very small area—yet at the same time the accuracy of all the diameters had to be held within plus or minus .002". A piercing die was designed to punch the quarter-inch holes in the housing's three "ears" as well as several undercuts impossible to cast. These holes were also held to plus or minus .002". ■ Serv-All knew Zamak could give them the castability they needed, could meet the demanding tolerances, could provide the high-strength, thin-wall sections required, and had the ductility for an accurate, easy piercing operation after casting. They also knew of the overall production economies inherent to Zamak—low die cost, long die life and high production speeds. One other characteristic of Zamak sealed the choice—the wide variety of finishing procedures which can be used. In this case the housing is copper-plated to facilitate soldering.



MOTOROLA TELEVISION TUNER HOUSING

AWARD OF MERIT

The New Jersey Zinc Company's "Zinc Die Casting of The Year" Competition

■ Zamak gives you more for less. How else would you make it?

HORSE HEAD® SPECIAL ZINC AND HORSE HEAD ZAMAK ARE PRODUCED BY

THE NEW JERSEY ZINC COMPANY

160 FRONT STREET • NEW YORK 38, N. Y.

DEVELOPERS OF THE ONLY STANDARD ZINC DIE CASTING ALLOYS IN USE TODAY

HORSE HEAD PRODUCTS

Circle No. 33 on Reader Service Card

1 Casting Process is Best For Your Specific Design...

Hampden Brass Offers 4 Different Methods To Choose From!

PERMANENT MOLD
Aluminum Alloys-High Purity Alloys

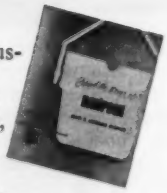
DIE CASTING
Aluminum Alloys-Zinc

SAND FOUNDRY
Aluminum Alloys-High Purity Alloys
Brass-Bronze-Monel

FIBERGLAS CASTING
High Quality Structural Fiberglas
Modern Vacuum Process

ONLY ONE IS BEST!
Let Hampden Brass's experts help you decide which process best suits your requirements . . . and help you produce a better product at lower cost!

Like to know more about Hampden Brass? Write for Illustrated Brochure, "Behind the Scenes" . . . a complete Digest of Hampden Brass's experience, equipment and facilities.



HB

For Guaranteed Quality . . .
Look to the Diamond of the Industry

Hampden Brass & Aluminum Company
Established 1903
SPRINGFIELD, MASSACHUSETTS

Complete Pattern, Machine, and Die Shops . . .
X-Ray and Laboratory . . . Heat Treat and Wheelabrator facilities

Circle No. 23 on Reader Service Card

useful literature, catalogs, manuals

200 **Vibratory Finishing Machine**—PANGBORN CORP.—Specifications on a self-contained vibratory finishing machine of 1⅛ cu. ft. capacity.

201 **Washing Equipment**—RAMCO EQUIPMENT CORP.—Bulletin describes pre-engineered power spray washing and phosphatizing equipment.

202 **Vacuum Coating**—CONSOLIDATED VACUUM CORP.—27-page Technical Booklet discusses the vacuum coating process and equipment necessary.

203 **Citric Acid**—MILES CHEMICAL CO.—30-page Brochure describes citric acids and their physical properties and application on metals.

204 **Wire Cloth**—CAMBRIDGE WIRE CLOTH CO.—Bulletin describes various types and grades of industrial wire cloth, includes trade definitions.

205 **Ultrasonic Cleaner**—L & R MFG. CO.—Data Sheet describes the Ultra-Cleen 320 ultrasonic cleaner, includes complete specifications.

206 **Polishing & Buffing**—LEA MFG. CO.—Brochure describes a complete line of supplies for plating and abrasive finishing.

207 **Abrasive Cleaning Equipment**—PANGBORN CORP.—12-page Brochure on LK & LM Roto-blast Table-Rooms designed to blast clean various-sized pieces, up to 10 feet in diameter.

ALLEN AIR

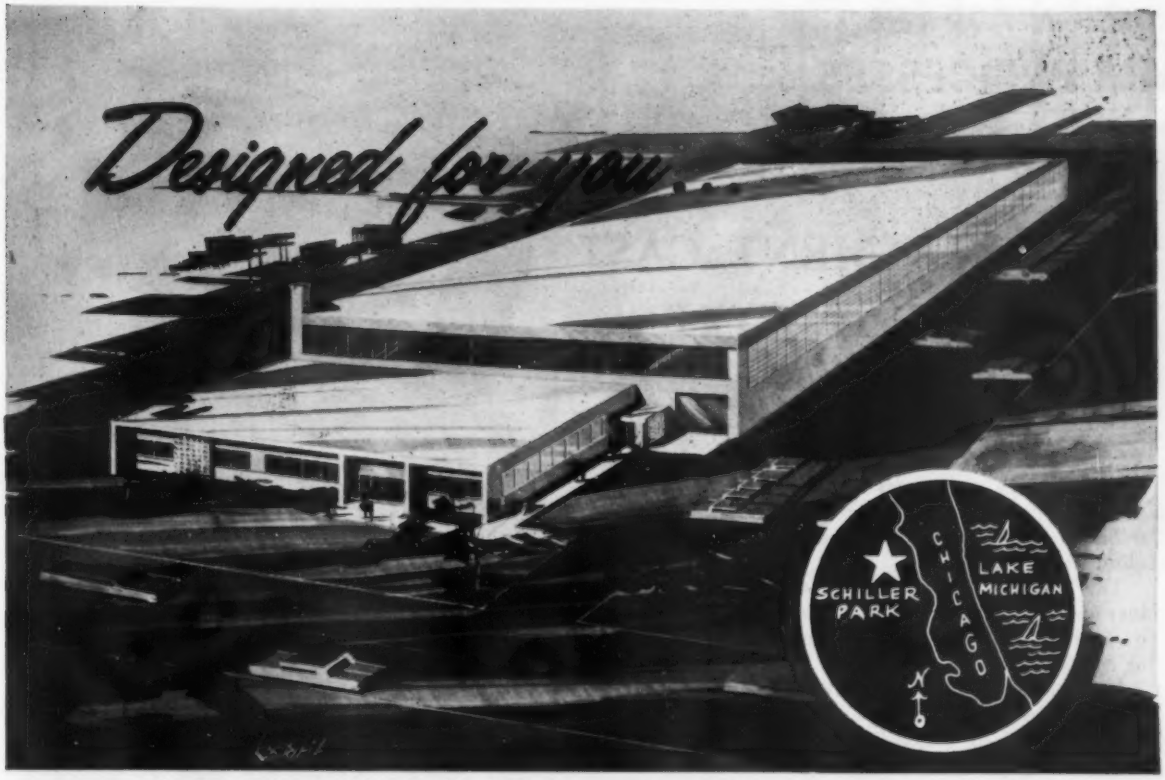
CYLINDERS • DIAL FEED TABLES
AIR VALVES & CLAMPS

NEW CATALOG AVAILABLE ON REQUEST
Write Before Next Tuesday!

ALLENAIR CORP., 255 East 2nd St., Mineola, N. Y. PMM-3

Name.....
Company.....
Address.....
City.....Zone.....State.....

Circle No. 3 on Reader Service Card



with America's finest facilities, equipment and men producing America's highest quality molds for the Die-Casting and Plastics Industries

ATOLS
Ultra-Precision
MOLDS

Yes, an all new plant, doubling previous floor area and increasing traveling crane capacity to 20 tons, equipped with the industry's most advanced tools, yet staffed by the same experienced men who have earned the praise of the nation's leading blue chip companies. We are proud of our new building but we take even greater pride in that many of the same companies whom we served at the very beginning of ATOLS are still our most valued customers. We dedicate our building to them and to those of you who take advantage of our invitation to investigate our facilities, our skill, our service.

For more than 25 years ATOLS has designed and produced precision made molds promptly and economically. We offer a complete service from design and engineering to the finished mold, with more than 100 men to serve you.

For complete details of our services and facilities, simply call or write. Your request will be answered promptly and courteously.

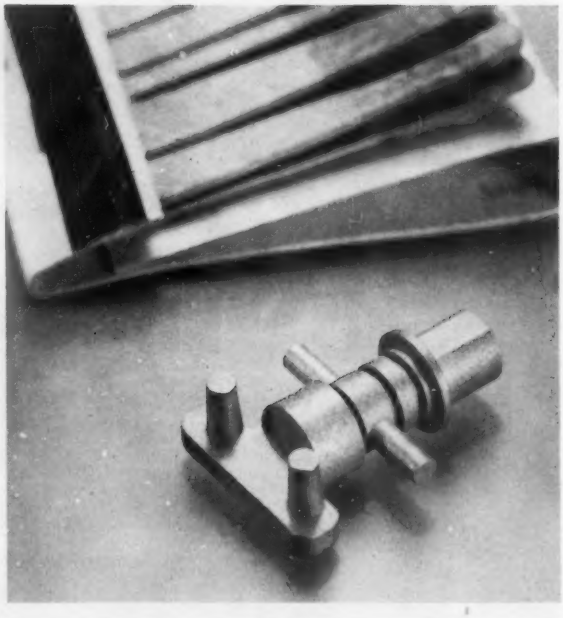
ATOLS TOOL and MOLD CORPORATION

3828 RIVER ROAD • Phone NAtional 5-6300 • SCHILLER PARK, ILLINOIS

Circle No. 86 on Reader Service Card

DESIGN FOR THE PMM PROCESSES

INVESTMENT CAST MICRO-SWITCH

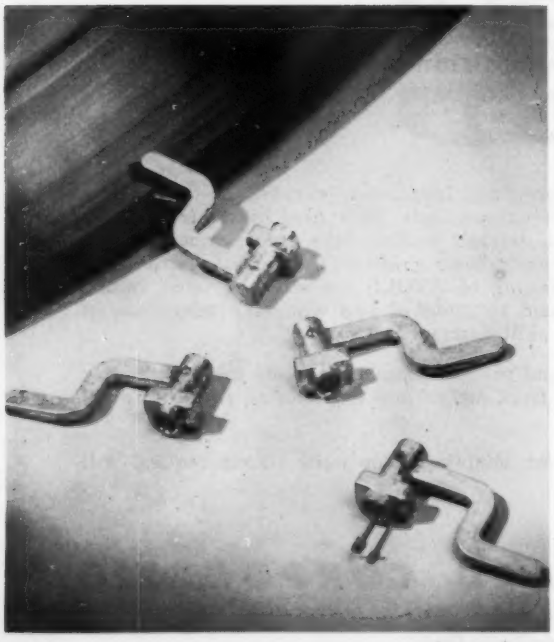


WHENEVER SMALL PARTS are machined and assembled, chances are good that a Precision Metal Molding process will cut costs. Lathe operations, milling, drilling, deburring and assembly are often eliminated.

This micro-switch assembly was redesigned for investment casting. The part, made of stainless steel, gives the user maximum corrosion resistance required at a 60% savings in cost.

By investment casting, smooth edges and surfaces are produced. Most critical area is the shaft diameter which is held to $\pm 0.002''$.

SMALL DIE CASTINGS FOR RECORD PLAYERS



TOO OFTEN WHEN a small die casting requires a secondary machining operation, the advantages of die casting are lost. Cost of production is increased. It is this secondary operation which Gries Reproducer Corp. eliminated in automatic production of the illustrated turn-over crank (needle holder) for three-speed record players.

Primary advantages to be gained in die casting the part in zinc are its; hardness, smooth as-cast surface, clean break with no rough edges at the parting line, and dimensional uniformity from part to part. This uniformity is important to the retailer who assumes that each holder will fit into his customer's record player. Parts must be interchangeable.

Automatic die casting eliminates the handling necessary to drill a small hole into the shaft of each holder. The cross-hole for pinning the shaft is fixed during the casting cycle.

The turnover crank is made for Jensen Industries, Inc., a manufacturer of high fidelity and other electronic components. It is made for a 78 rpm, 3 mil needle on one side and a long play 33 or 45 rpm, 1 mil needle on the reverse. The tab swings up and is visible alongside the playing arm to indicate which needle is in use.

new products & developments

Continued from page 27

Adjustable recorder

BARBER-COLMAN CO.—No external calibrating means are necessary for this adjustable span and zero recorder. The zero and span settings are on calibrated dials, and both are accurate to ½%.

Circle No. 258 on Reader Service Card

Ball bushings

THE KOTULA CO., INC.—A ball bushing, or linear ball bearing, for use on trim press die sets, has been developed by Kotula Co. The bearing is interchangeable with standard plain bronze or steel bushings in existing dies.

Circle No. 259 on Reader Service Card

Rotary pilotor

MICROMETRICAL MFG. CO.—A new rotary pilotor provides a means for high production checking of average surface roughness in micro-inches around surfaces of rotation and across the radii of small parts, both external and internal.

Circle No. 260 on Reader Service Card

Laboratory filters

MICRO METALLIC DIV.—All-stainless steel beaker filters are part of a redesigned line of laboratory filters including immersion tubes (porous bottom side only) and gas dispersion tubes (porous stem side). They are available in five porosity grades.

Circle No. 261 on Reader Service Card

more New Products on next page

THIS TRIGGER is your control over mold cavity surfaces - cleans, cools, lubricates in ONE OPERATION

SELF-AGITATING LUBRICANT CONTAINER

Get more *usable* castings with the P-W SYSTEM—universally accepted throughout the die casting industry.

GUN UNITS AVAILABLE SEPARATELY

Write for additional information to

PIERCE-WALLER, INC.

KETTERING P. O. Box 2121
DAYTON 29, OHIO

Circle No. 82 on Reader Service Card

CARBIDE TOOL & DIE COSTS CUT . . . .

the GENTRY Elektrojet Way

With new equipment such as Cincinnati Elektrojet, GENTRY has modernized manufacture of high-quality carbide tools and dies for powdered metal parts. Costs are cut three ways:

- More power with Elektrojet new 60-amp units.
- Grinding operations are eliminated.
- Make shelf dies that are impossible by other methods.

Quality work is guaranteed.

Our free brochure tells what our engineering services can do for you on carbide tools, dies, jigs and fixtures.

GENTRY
CARBIDE TOOL & DIE CO., INC.
127 MAIN STREET BEECH GROVE, INDIANA
PHONE: ST. 7-2228

Circle No. 68 on Reader Service Card

"TIFFIN POTS LAST LONGER"

This is a report that we continue to receive from our customers.

Standard melting kettles and machine pots direct from stock are available for all non-ferrous metals.

Special pots are made to your specifications.

We also furnish the following parts in Tiffin alloyd iron or alloyd steel:

- PLUNGERS
- NOZZLES
- GOOSENECK NOSES
- THERMO COUPLES
- INGOT MOLDS
- BAR STOCK

All parts are especially engineered to give the best possible service in the die casting field.

OVER 50 YEARS EXPERIENCE in the manufacture of quality pots and die equipment.

FREE BROCHURE lists stock pots.

Be Thrifty — Be Wise
Use The Best . . .

THE TIFFIN FOUNDRY, INC.

Phone: Gibson 7-3991
TIFFIN, OHIO

Circle No. 48 on Reader Service Card

new products & developments

Heat treating furnace

WALTZ FURNACE CO.—A small heat treating furnace, designed for toolroom use, heats to maximum of 1850°F. Tools, dies and small production parts made of both oil and water hardening steel, can be heated, quenched, drawn. The furnace can also be used for stress relieving, normalizing, and annealing under controlled atmospheres.

Circle No. 239 on Reader Service Card

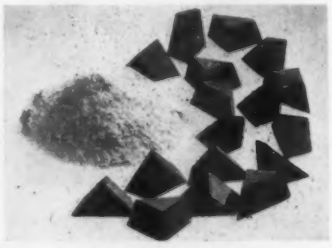
Barrel finishing machine

ALMCO PRECISION FINISHING—Model DB-1616 deburring and finishing machine is low-cost and saves on floor space. A choice of barrel sizes permits a large or small number of parts to be processed. The unit has a 2 cu. ft. capacity and occupies only 4.8 sq. ft. of floor space.

Circle No. 239 on Reader Service Card

Barrel finishing compound

MINNESOTA MINING & MFG. CO.—Its new burnishing compound is devised to hold better color



in barrel finishing zinc die castings, steel and most alloys. The compound is a free flowing soap type.

Circle No. 240 on Reader Service Card

Heat exchanger

JAS. A. MURPHY & CO., INC.—The Murphy Aftercooler, a small air-to-water heat exchanger, is built for capacities

of 50 to 120 cubic feet of free air per minute. The unit is guaranteed to cool air to within 85% of the cooling water temperature.

Circle No. 241 on Reader Service Card

Motor degreaser

SPRAYON PRODUCTS, INC.—No. 701 Spray in an aerosol can is made especially for quick, thorough degreasing of electric motors in complete safety. No washing or flushing is needed. Just spray it on and wipe it off.

Circle No. 242 on Reader Service Card

more New Products on page 84

BADGER DIE CASTING

WILL GIVE YOU THE CORRECT ANALYSIS OF THE ECONOMIES TO BE OBTAINED FROM DIE CASTING IN ZINC OR ALUMINUM IN ANY QUANTITY.

BADGER DIE CASTING CORP. 201 W. Oklahoma Ave. Milwaukee 7, Wis.

Circle No. 10 on Reader Service Card

Versatility and low cost make Zinc superior metal for die casting

Versatility and low cost are two key reasons for die casting with zinc. Characteristics like good dimensional stability, close casting tolerances, high strength-to-weight ratio, excellent finish, point up the metal's versatility. Initially a low cost metal, zinc's low melting point makes possible further cost savings with longer die life and faster press operation. In addition, smooth "as cast" surfaces mean minimum finishing cost.

BUY

TADANAC SHG MADE IN CANADA

TADANAC

SPECIAL HIGH GRADE ZINC

TADANAC Brand Special High Grade Zinc, electrolytically refined under carefully controlled conditions, has the overall purity and the low individual impurity content (determined spectrographically) to ensure it is completely satisfactory for die cast alloy manufacture.

DELIVERY – UNIFORMITY – SERVICE

From a single refinery Cominco produces over 500 tons of zinc a day. This assures our customers consistent, prompt delivery of metal of uniform high quality.

Our Technical Service is ready at all times to assist you to use TADANAC zinc to your best advantage.

TADANAC SHG *FOR DIE CAST QUALITY*

COMINCO

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED, MONTREAL

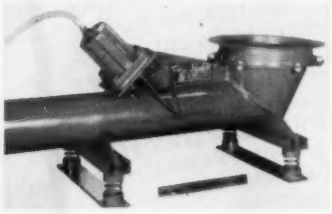
Tadanac Brand Metals are sold in United States by American Metal Climax, Inc., New York, Chicago, Detroit, Los Angeles

Circle No. 17 on Reader Service Card

new products & developments

Vibrating conveyor

CLEVELAND VIBRATOR CO.—Bulk quantities of pelleted metals can



be moved without dust or contamination with this air-powered vibrating conveyor. Steady, rapid vibrations carry even the most brittle materials without chipping or breaking. The unit is air-cushioned for quiet operation.

Circle No. 248 on Reader Service Card

Thermocouple junction

TEMPTRON, INC.—The model TRJ-3006 elevated temperature thermocouple reference junction is a low cost, compact, portable unit for plant and laboratory use. It is designed around a simple, on-off type temperature control system.

Circle No. 249 on Reader Service Card

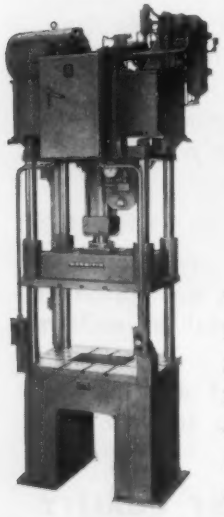
HANNIFIN

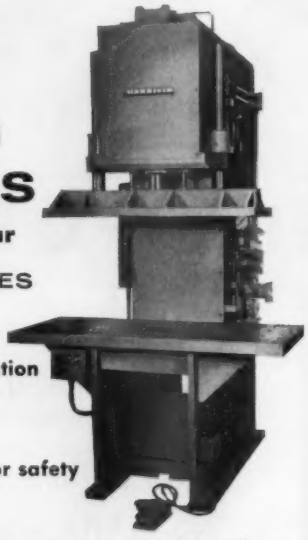
HYDRAULIC

DIE CASTING TRIM PRESSES

Give you more parts per hour

OPEN GAP OR COLUMN TYPES





- High speed operation
- Easier set-up
- Longer die life
- Complete operator safety
- 2 to 150 tons

Faster Speeds • Lower Prices • Quick Delivery

YOU GET THESE FEATURES:

1. Safe, dual electric (or hand) controls
2. Automatic reverse on pressure or distance (adjustable)
3. Adjustable ram pressure
4. Extra-large tables standard
5. All-steel welded and stress-relieved construction
6. Hardened and chrome-plated rams and guide rods

For the full story of the advantages of high speed hydraulic trimming, send for our Bulletin 142. Or call in your Hannifin representative—he's a trained production analyst.

3164PH

PARKER HANNIFIN CORPORATION

HANNIFIN COMPANY

A DIVISION

581 South Wolf Road • Des Plaines, Illinois

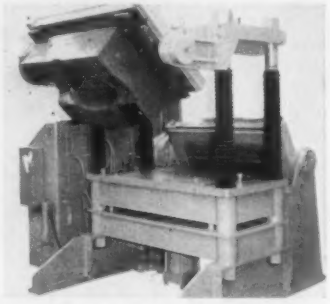
PNEUMATIC AND HYDRAULIC SYSTEM COMPONENTS

EUROPEAN DIVISION • PARKER-HANNIFIN N.V. • SCHIPHOL • THE NETHERLANDS

Circle No. 73 on Reader Service Card

Die & mold equipment

SANDERS TOOL & PRODUCTION CO.—Tilt-A-Die speeds up die casting die and trim die production. Spotting-in time can be



speeded safely up to 70% thereby ending costly die and mold room bottlenecks.

Circle No. 250 on Reader Service Card

Vacuum furnace

IPSEN INDUSTRIES, INC.—The VVD-10x14 vacuum-purge controlled-atmosphere tempering furnace is designed primarily to bright temper work previously heat treated in the VVFC-10x14. Work does not have to be removed from the basket when used in conjunction with the latter unit. The furnace can also be used for annealing and precipitation hardening.

Circle No. 251 on Reader Service Card

Tapping head

ETTCO TOOL & MACHINE CO.—The lead screw tapping head has an actuating lever and stop

and depth control as integral parts. It fits any drill press. It will drive taps up to 5/16" and as fine as #0. No hold-down or stripper plates are required.

Circle No. 252 on Reader Service Card

Circle No. 36 on Reader Service Card

POWDER CONDITIONING AND PROCESSING

METALLIC AND NON-METALLIC POWDERS GROUND TO YOUR SPECIFICATIONS

- IRON POWDER
- FERRO PHOSPHOROUS
- FERRITES
- MILL SCALE
- COPPER
- TUNGSTEN
- COBALT
- NON-METALLICS
- SOLID CHEMICALS

SCREENING AND PARTICLE SIZE CLASSIFICATION

OPEN TIME AVAILABLE

MICRO METALS
CORPORATION
99 President St. Passaic, N. J.
Dept. No. 3A
Member Metal Powder Ind. Fed.

Humidifier

BEHR-MANNING CO.—A low-cost humidifier prevents edge cupping or curling of coated abrasive belts in dry atmospheres. The unit permits increased belt life, the ability to exert higher grinding pressures, and improved grinding and finishing performance.

The humidifier corrects the tendency of abrasive belts to curl at the edges when operated in low humidity.

Circle No. 243 on Reader Service Card

Drill press

CIA USING DIV.—A new line of 15" bench and floor model, heavy-duty, general purpose drill presses incorporate many exclusive features for greater accuracy, capacity, and efficiency. Heavier throughout than drills of comparable size, they are available with a choice of positive power, variable speed drives.

Circle No. 244 on Reader Service Card

more New Products on next page

5th in a series of POWDERED METAL PARTS applications by REESE

Powdered Metals . . .

NEW WAY TO MAKE PADLOCKS

By-passing castings and extrusions, the major parts of this brass padlock for the government are made of Reese powdered metal parts. Higher precision and lower cost result by designing the lock to take full advantage of the powder metal process. All parts meet government specs MIL-B-12128A.

FREE BROCHURE
"How to Cut Precision Parts Costs with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

REESE
METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
Oilless Bearings • Bushings
Machine and Structural Parts in
COPPER • BRASS • IRON
ALLOY STEEL • NICKEL SILVER
COPPER INFILTRATED IRON

Circle No. 44 on Reader Service Card

DON'T MISS YOUR MAY BONUS *

It's the month of the Design Engineering Show in Detroit. All eyes will be focused on new materials, processes and finishes. Thousands of designers and buyers of metal components will be at the Show.

*** PMM's EDITORIAL BONUS**

PMM will be at the Show, too, with an issue giving special heed to the *design engineering of PMM parts.*

Whether or not you're at the Show (and we hope to see you there) you'll get the benefits of PMM's big May issue.

Advertisers: Reserve Space Now!

Advertisers in May PMM gain from the high impact editorial material, added Show circulation, and a favorable setting for your sales message. A phone call or letter will reserve space for your ad. Closing date is April 1. Regular rates apply.

Precision Metal Molding
812 Huron Rd., Cleveland 15, Ohio

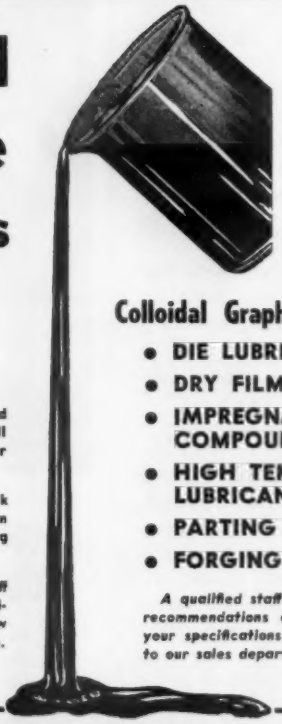
Circle No. 21 on Reader Service Card

Colloidal Graphite dispersions

can help you

3 WAYS:

1. **Production** — For established production processes we will prepare dispersions to meet your specifications.
2. **Development** — We will work directly with your engineers on development projects requiring specialized dispersions.
3. **Research** — Our research staff is always available for consultation on new products, new processes and new applications.



Here are a few uses of

Colloidal Graphite Dispersions:

- DIE LUBRICANT
- DRY FILM LUBRICANT
- IMPREGNATING COMPOUND
- HIGH TEMPERATURE LUBRICANT
- PARTING COMPOUND
- FORGING COMPOUND

A qualified staff is available for prompt recommendations and quotations to meet your specifications or preliminary inquiries to our sales department.

GRAPHITE PRODUCTS CORP.
BROOKFIELD, OHIO

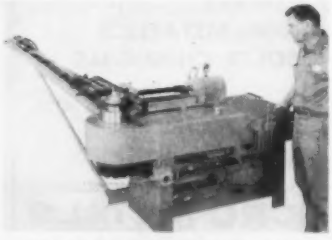
new products & developments

Industrial X-ray unit

PICKER X-RAY CORP.—A heavy-duty industrial X-ray machine produces images of exceptional sharpness for testing and inspection. The unit can reveal very small defects and is especially suited to industries requiring large amounts of non-destructive inspection.

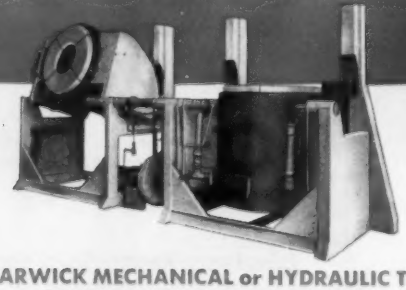
Circle No. 253 on Reader Service Card

Bending machine



COSTELLO ENGINEERING CORP.—Designed for use in cramped quarters, this machine for bending extrusions, pipes, and tubing

LOOK more New "tuff built" **WARWICK FURNACES**



All WARWICK Furnaces are designed and built to "take it"... deliver melt after melt with speed, efficiency and economy. They are the furnaces that you should investigate first before buying.

WARWICK MECHANICAL or HYDRAULIC TILT CRUCIBLE MELTING FURNACES

For brass, bronze, aluminum and other non-ferrous metals. Nose Pour feature assures a constant pouring arc, eliminating the necessity of moving the ladle at any time during a pour. They are excellent for use in permanent mold and die casting plants as well as any foundry. Their sturdy construction assures longest life, and their economical operation results in lowest production costs. Oil or Gas Fire. Built in sizes to handle capacities from No. 30 to No. 2000 Crucible.

WARWICK MANUAL TILT CRUCIBLE MELTING FURNACES
For Brass, Bronze, Aluminum

Designed for utmost production and longest crucible life. Assures perfect melts every time. Is so easy to operate and extremely economical. Oil or Gas Fire. Capacities from No. 30 to No. 1000 Crucible.

Warwick INDUSTRIAL
FURNACE & ENGINEERING CORP.
SINCE 1895
452 West Chicago Avenue — Chicago 10, Ill.

Remember . . . WARWICK makes all types of furnaces for the finest and fastest melting of aluminum, magnesium, brass, bronze, and all other non-ferrous metals. Get the facts on how they can save you money. Write today for full information.

Circle No. 69 on Reader Service Card

has removable mandrel support beams. A following action of the pressure die assures bends free from galling, scratching, and abrasion.

Circle No. 254 on Reader Service Card

Rotary press die-feeder

F. J. STOKES CORP.—The new "Force-Flo" die feeder can tablet dry-blended powders in a single operation. It allows you to operate at higher speeds, gives denser, higher quality tablets with less pressure by minimizing air-entrapment, laminating and capping.

Circle No. 255 on Reader Service Card

Ultrasonic cleaners

L & R MFG. CO.—Some additions to the Ultra-Clean 320 Series are designed to ultrasonically clean a large volume of precision parts at high speeds with a minimum of attention.

Circle No. 256 on Reader Service Card

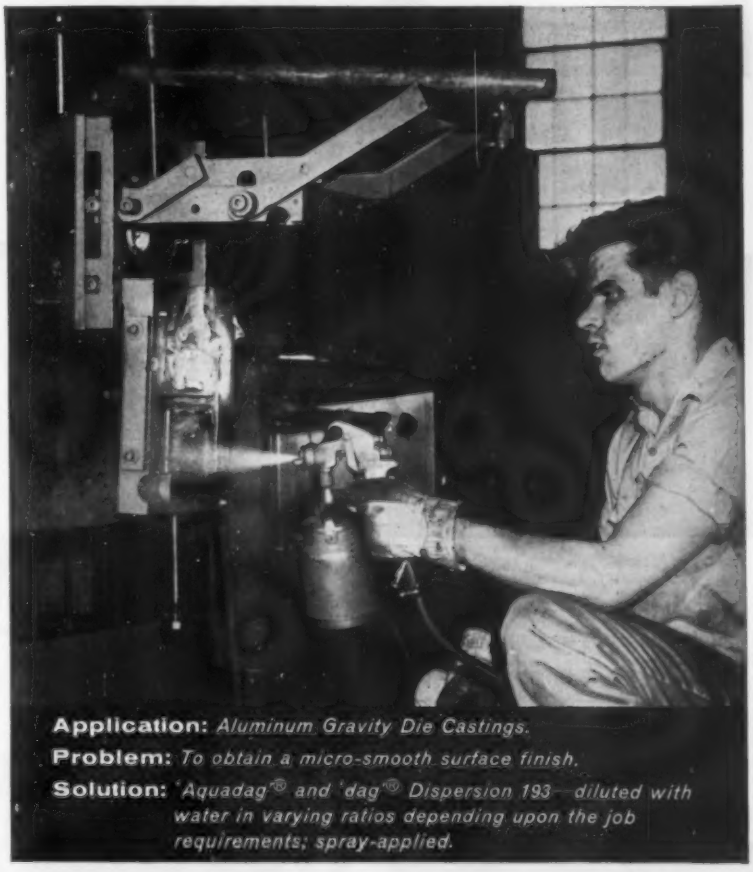
Spray coating accessories

CONFORMING MATRIX CORP.—The new magazine loader stacks in a portable magazine 40 loaded trays of axial lead components after they pass through the paint-

ing station of the HD-3 remote spray coater. Parts can be purchased individually.

Circle No. 257 on Reader Service Card

DIE CASTING REPORT



Application: *Aluminum Gravity Die Castings.*

Problem: *To obtain a micro-smooth surface finish.*

Solution: *'Aquadag'® and 'dag'® Dispersion 193 — diluted with water in varying ratios depending upon the job requirements; spray-applied.*

RESULT: *SURFACE FINISHES ON ALUMINUM CASTINGS AS SMOOTH AS 40 to 60 MICROINCHES*

Akron Gravity Die Casting Company, Akron, Ohio, has built a reputation on products with exceptional surface quality. These micro-smooth finishes . . . comparable to a tool room grind . . . have been insured by using Acheson's 'Aquadag' as a parting agent and 'dag' 193 as an insulating coating. By using the materials in these separate functions, Akron Gravity is able to achieve proper metal flow throughout the die cavity — eliminating deposit build-up, premature solidification, and metal-to-metal alloying. As a result they get both better casting surface finishes and longer die life.

The consistent uniformity, quality performance, and versatility of Acheson mold coatings for metal casting, are covered in Bulletin No. 425. Send for your copy, care of Dept. PMM31.

ACHESON — First name in solid lubricants for fifty-three years.

ACHESON Colloids Company

PORT HURON, MICHIGAN

A division of Acheson Industries, Inc.
Also Acheson Industries (Europe) Ltd. and affiliates, London, England.
Sales offices in principal cities.

Circle No. 1 on Reader Service Card

Circle No. 83 on Reader Service Card

KOZMA

INDUSTRIAL PROCESSING FURNACES
. . . since 1928

THE PERFECT PAIR FOR DIE CASTING

A Kozma Melting and Holding Furnace, in combination with the revolutionary, new Kozma Automatic Ladle, delivers highest quality metal . . . at lowest possible cost.

Kozma Model RSHCH-600G Melting and Holding Furnace

Exclusive Kozma "Pre-Temp" charging and sub-surface metal flow practically eliminates oxygen and hydrogen pick-up and oxide inclusions, keeping metal at high purity level.

Radiant firing provides faster, more uniform heat distribution, eliminates flame impingement and reduces fuel costs.

Kozma Model RSHCH Furnaces range in capacity from 300 to 2,000 lbs. per hour with design variations to meet your requirements.

Kozma Automatic Ladle

The Kozma Automatic Ladle is fast . . . dependable . . . low cost . . . with ½ ounce "shot-to-shot" accuracy. Bottom entry and cover provide sub-surface fill to assure delivery of clean metal to the cold chamber. Will deliver accurately up to 300 shots per hour.

Write today for complete information on improving the quality of your die castings . . . and reducing your costs.

J. A. KOZMA Company
2471 WYOMING
DEARBORN, MICHIGAN

RADIANT FIRED FURNACES UNEQUALLED FOR LOW POROSITY ALUMINUM CASTINGS

Circle No. 77 on Reader Service Card

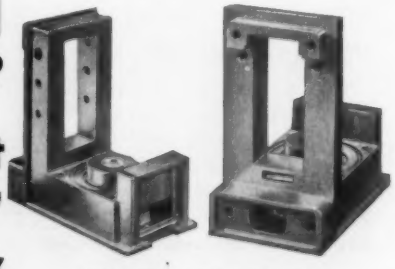
SELLERS OF

'METALKAT'
BRAND ELECTROLYTIC ZINC

SPECIAL HIGH GRADE 99.995% +
HIGH GRADE 99.95%

INDUSSA CORPORATION
511 Fifth Avenue New York 17, New York Tel: MUrray Hill 2-4680
Cable: Indussa New York Telex: 4301 New York

Dimensional Accuracy?
YES... but Other 'Specs' are Equally Exacting!



Two views of zinc die-cast body for Air Controlled Timing Valve.

In addition to exacting dimensional tolerances, users of die castings often require other equally precise specifications to be met. For example, in the zinc die-cast body for the Air Controlled Timing Valve pictured, the following requirements were specified to insure successful assembly and functioning: absolute *solidity* and *high density* of the zinc alloy to prevent air leakage — along with a cast-in diaphragm surface absolutely smooth and free from imperfections; bottom of rectangular hole free from burrs; all plane surfaces flat and either parallel or square to one another.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

Milwaukee has been meeting exacting requirements like these for more than a half century!

MILWAUKEE DIE CASTING COMPANY
4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN
Established 1909

Circle No. 37 on Reader Service Card

PMM

book review

MACHINING CHARACTERISTICS OF HIGH STRENGTH THERMAL RESISTANT MATERIALS, AMC Technical Report 60-7-532; Curtis-Wright Corporation, Wood-Ridge, New Jersey, 1960. 180 pages. $4.60.

• • •

The increasing use of high strength, thermal-resistant alloys in the aerospace industry has prompted the Air Force to sponsor this study on the machining characteristics of these alloys.

The turning, milling, drilling, and tapping characteristics of 25 high strength, thermal resistant alloys are covered. Full information is presented on the relationships between tool life, cutting speed, feed, tool geometry, tool material, and cutting fluids.

Tables, graphs, and schematic diagrams makes the book an easy-to-use reference.

Circle No. 50 on Reader Service Card

Hot-Work Tool Steels

For Every Need

When you need Hot-Work Tool Steels, for standard or severe applications, turn to UDDEHOLM for a superior Swedish quality to satisfy your most exacting requirements. Our mills in Sweden produce grades that have exceptional toughness, will retain high hot-hardness and resist heat-checking, to give long production runs.

Specify these grades for economy with UDDEHOLM Swedish Quality!

For Brass and other high-temperature alloy Die Casting, Hot Press Forging and Hot Extrusion Dies — UDDEHOLM'S exclusive **UHB CALDUR** • **UHB CALMAX**
For Aluminum, Magnesium, long-run Zinc Die Casting — **UHB ORVAR** — SAE H-13
For Aluminum Hot Extrusion Operations — **UHB SPECIAL** — SAE H-12
For Zinc Die Casting — Cold Hobbed Dies — **UHB PREMO** — SAE P-4

UDDEHOLM Tool Steel Service Centers stock
the grade, size and shape of Hot Work or Cold Work tool steels you need — ready for prompt delivery to you!

Send for Technical information and stock list on any grade you require.

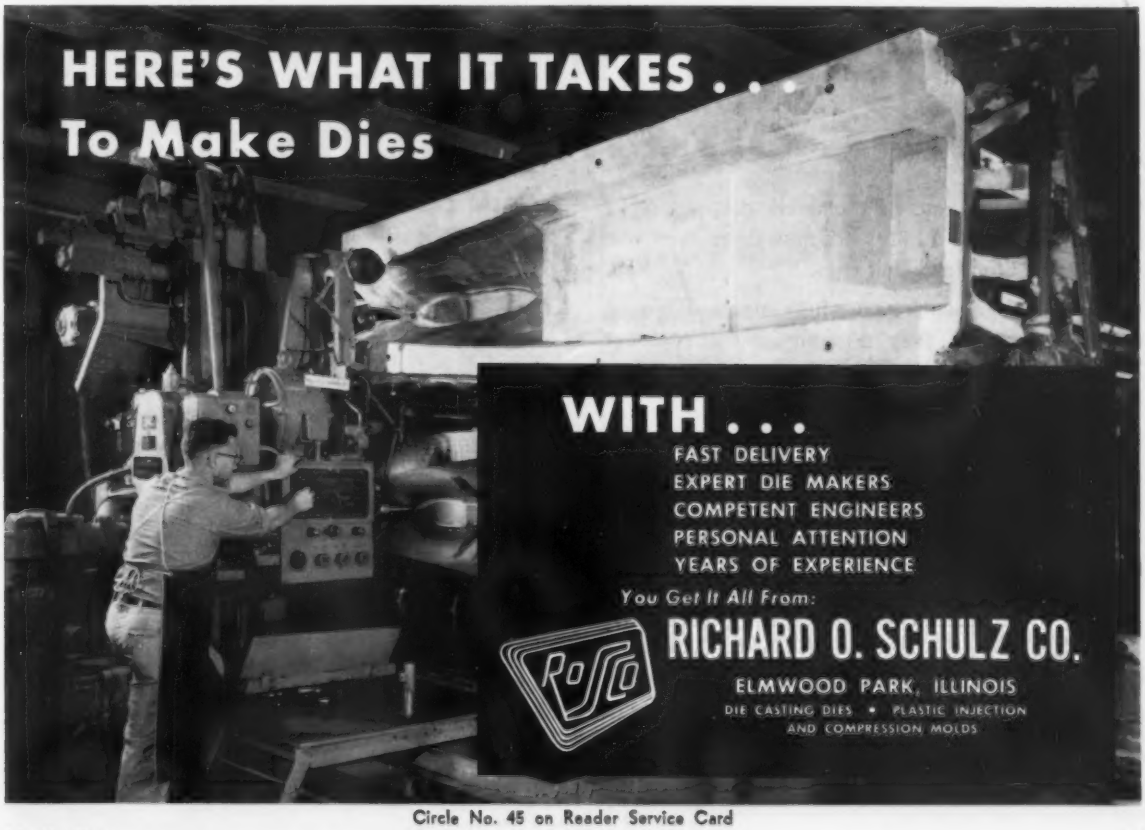
UHB TOOL & DIE STEELS COLD ROLLED SPRING STEELS

UDDEHOLM CO. OF AMERICA

155 East 44th St., New York 17, N. Y., MUrray Hill 7-4575

Serving American Industry for more than 70 years

Branch Offices & Warehouses — Chicago, Ill. — Cleveland, O. — Detroit, Mich. — Los Angeles, Calif. — Newington, Conn. — Philadelphia, Pa. — **In Canada** — Uddeholm (Canada) Ltd., Montreal — Toronto



Circle No. 45 on Reader Service Card

Why the DIE CASTER

talks D-M-E STANDARD UNIT DIES to the Die Designer and Die Maker

Changeover time goes down ...Profits on short runs go up!

Die changes on zinc or aluminum castings which normally take 3 to 5 hours are now done in minutes with D-M-E Standard Unit Dies.

D-M-E Replacement Units are fully interchangeable: Quickly and easily they're taken out and replaced in the Unit Holder . . . production is continued immediately!

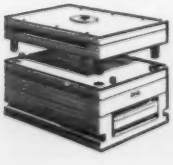
Because several jobs can run on one machine, you increase profits on short run jobs. What's more, you get the quality, the performance and the standardization of replacement parts needed for volume production work.

DIE CASTERS, DESIGNERS AND DIE MAKERS GET MORE FROM D-M-E!

• AVAILABILITY: D-M-E Replacement Units are carried in stock at your local D-M-E Branch for quick delivery. • VARIETY: D-M-E Replacement Units are available in your choice of steel and hardness. • UTILITY: D-M-E has a Standard Unit Die to fit your machine, whether you require rack and pinion or automatic "bumper-type" ejection. • FLEXIBILITY: Complete freedom on three sides of the cavity for core or cooling line placement; six leader pins and bushings for accurate alignment; "quick change" wedge clamps for positive plate positioning. • Start increasing profits on your short-run jobs with D-M-E Standard Unit Dies!

Write for your free copy of *Lower Die Cost Through Standardization.*

61-A-DC



DME

DETROIT MOLD ENGINEERING COMPANY

6686 E. McNichols Road — Detroit 12, Michigan — TWinbrook 1-1300

Chicago • Hillside, N. J. • Los Angeles • D-M-E Corp., Cleveland, Dayton
D-M-E of Canada, Inc., Toronto

Injection and Compression Mold Bases • Injection Unit Molds • Cavity Retainer Sets • Mold Plates • Ejector and Core Pins
Ejector Sleeves • Leader Pins and Bushings • Sprue Bushings • Moldmakers' Tools and Supplies

Circle No. 20 on Reader Service Card

PMM

opportunities

jobs and equipment

Opportunities rates: $20 for the first column-inch; $15 for each additional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Road, Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSTION OPEN

POWDER METALLURGY—Plant expansion has created openings for qualified men. Production openings in these departments—sintering, secondary machining operations, quality control and metallurgy. Also product and process engineers. Salary and all usual benefits, in Mid-Western location. Box 3161.

INVESTMENT CASTING SALESMAN—Nationally-operating investment casting company seeks direct employees to sell in California and Arizona. Residence area will be Los Angeles or vicinity.

Benefits are exceptional, including participation in profits, a company-supplied car, and many others.

Background and experience in investment casting sales is critical. Knowledge of engineering, metallurgy, etc., is highly desired, as is knowledge of and association with aircraft and related companies.

Candidates should state background, income desired, date of availability for employment, and any other items of interest, in their response.

This is a permanent, full-time job.
Please address replies to Box 3261.
All replies will be held confidential.

MANUFACTURER has opening for machine and die designer specializing in small zinc die castings. This man should be experienced in high speed zinc die casting methods and the design of special die casting machines. Box 3561.

REPRESENTATIVES WANTED—Manufacturers Representatives wanted for Midwest producer of Zinc and Aluminum Die Castings in the following states: Ind., Mich., Kan., Ohio, Ia., Minn., Ky. & Mo. ADCI Member. Box 3661.

MEN, SELLING OR SERVICING THE DIE-CASTING INDUSTRY. As part of Chem-Trend's expansion program, we are seeking representation for our new Die Lubricant, developed for higher mold and melt temperatures. Because of its unique features, this product has been enthusiastically accepted, virtually everywhere it has been introduced. This is really a ground floor opportunity for the right men. CONTACT: CHEM-TREND,4880 U.S. 23, BRIGHTON, MICHIGAN.

POSITION WANTED

AVAILABLE—Die Casting Superintendent or General Foreman. Twenty years experience. Will relocate. Box 3461.

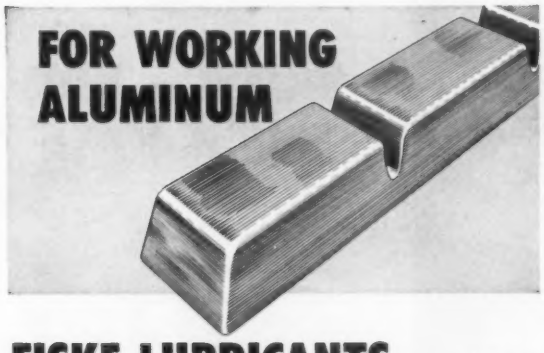
YOUNG MAN with 13 yrs. experience in Al. die casting, 7 yrs. as a Prod. Super., wants employment on a permanent or monthly consulting basis.

Thoroughly familiar with auto. cycling, gating, venting, die temp. control and methods of applying the vacuum process in producing quality castings on a competitive basis. Will relocate. Complete resume on request. Box 3361.

EQUIPMENT

WANTED—Used DIE CAST MACHINES and Secondary equipment of any type. Iron Machinery Co., 400 East 142nd St., Dolton, Illinois.

FOR SALE DIE CASTING MACHINES—
One Kux BH 18—Zinc
One Reed—Prentice 1½ G—Aluminum
(very reasonable)
Modern Die Casting Corp.
5419 N. Kedzie Ave.
Chicago 25, Illinois



FISKE LUBRICANTS are especially formulated for working aluminum and aluminum alloys. They will enable you to produce clean aluminum products at lower cost.

Machining	**C.S.A. No. 2 Cutting Oil**
Rolling	**Majestic Soluble Oil**
Die Casting	**231 Die Casting Compound**
Extruding	**514A Hot Die Lubricant**
Stamping	**Magic Compound**
Forming	**Magic Compound**
Wire Drawing	**Magic Compound**

Let us know how you work aluminum and we will send you the bulletin that describes the Fiske Lubricant made for your industry.

FISKE'S Since 1870 METAL WORKING LUBRICANTS

FISKE BROTHERS REFINING CO.
129D Lockwood Street, Newark 5, N. J.
Plants: Newark 5, N. J. and Toledo 5, Ohio

Circle No. 74 on Reader Service Card

METALLURGISTS and POWDER METALLURGISTS

Three challenging positions in the powder metallurgy field with one of the large iron powder producers.

SERVICE ENGINEERING—

5-10 years experience in applied powder metallurgy and parts manufacturing. Applicant must be willing to travel about 30% of the time.

DEVELOPMENT, PRODUCTION—

Position of major responsibility, pilot plant development, thorough theoretical and practical knowledge of metallurgy necessary.

RESEARCH AND DEVELOPMENT—

Laboratory position for recent graduate metallurgist.

Interested metallurgists should send their resume, marked to the attention of the president. All information will be treated strictly confidential.

HOEGANAES SPONGE IRON CORP.
RIVERTON, NEW JERSEY

PMM index of advertisers

A

Acheson Colloids Co. 87
Alan Wood Steel Co. 19
AllenAir Corp. 78
Alloys & Chemicals Corp. 15
Aluminum Smelting & Refining Corp. ..... Cov. II
American Smelting & Refining Co. Federated Metals Div. 5
American Zinc Sales Co. 26
Apex Smelting Co. ..... Cov. IV
Atols Tool & Mold Corp. 79

B

B&T Machinery Co. 49
B.I.P. Engineering Ltd. 69
Badger Die Casting Corp. 82
Baldwin-Lima-Hamilton Corp. Industrial Equipment Div. 74
Bethlehem Steel Co. 32
Brown Boveri Corp. 29

C

Cannon-Muskegon Corp. 28
Cast-Master, H-P-M Div. 1
Celanese Chemical Co. 30
Certified Alloys Co. ..... Cov. II
Cleveland Automatic Machine Co. 11
Consolidated Mining & Smelting Co. of Canada Ltd. 83

D

Delaware Machinery & Tool Co., Inc. 69
Detroit Mold Engineering Co. 90

E

Ettco Tool & Machine Co. 67

F

Fiske Brothers Refining Co. 91

G

Gentry Carbide Tool & Die Co., Inc. 81
Graphite Products Corp. 86
Gries Reproducer Corp. 69

H

Hammond Machinery Builders, Inc. 66
Hampden Brass & Aluminum Co. 78
Heatbath Corp. 67
Hitchiner Manufacturing Co. 14
Hoeganaes Sponge Iron Corp. 23
Hoover Co., The ..... Cov. III
E. F. Houghton & Co. 25
H-P-M Div., Koehring Co. 1

I

Indussa Corp. 89
International Minerals & Metals Corp. 92

K

J. A. Kozma Co. 88
Kux Machine Co. 72

L

Latrobe Die Casting Co. 4
Lester-Phoenix, Inc. 7
Leyden Hydraulics, Inc. 14
Lindberg Engineering Co. ..... 8 & 9

M

Madison-Kipp Corp. 24
Micro Metals Corp. 85
Milwaukee Die Casting Co. 88
Misco Precision Casting Co. 6
Mt. Vernon Die Casting Corp. 31

N

New England Die Casting 34
New Jersey Zinc Co., The ..... 76 & 77

O

Oakite Products, Inc. 70

P

Paramount Die Casting Co. 67
Parker-Hannifin Corp. 84
Pierce-Waller, Inc. 81
PMD Extrusion Die Co. 22
Precision Castings Co. 62
Premier Die Casting Co. 16

R

Reese Metal Products Corp. 85

S

R. O. Schulz Co. 89
Sherritt Gordon Mines Ltd. 33
G. W. Smith & Sons, Inc. 60
St. Joseph Lead Co. ..... 12 & 13
F. J. Stokes Corp. 71
Superior Industries, Inc. 2
Syntron Co. 68

T

Tiffin Foundry, Inc., The 81
A. Triulzi 18

U

Uddeholm Co. of America, Inc. 88
Union Carbide Chemicals Co. 17

V

Vascoloy-Ramet Corp. 20

W

Warwick Industrial Furnace & Engineering Corp. 86
West Instrument Corp. 65

Y

Youngstown Foundry & Machine Co., The 58

HUDSON BAY

SLAB ZINC 99.99+%

A QUALITY PRODUCT WHICH MEETS THE MOST EXACTING REQUIREMENTS OF THE DIE CASTING INDUSTRY

INTERNATIONAL MINERALS and METALS CORPORATION

11 BROADWAY • NEW YORK 4, N.Y.

Circle No. 30 on Reader Service Card

If it's speed you're after...

call a Hoover Man

Hoover's not directly involved with space travel. But we're a down-to-earth company serving many topflight industries. We produce quality castings, and have been doing it for 36 years. Whatever you want in aluminum or zinc alloy castings, you can count on Hoover for speedy service. We'd like to prove it to you. Call one of our Sales Engineers . . . he'll give you the whole story.

THE HOOVER COMPANY, Die Casting Division, North Canton, Ohio
In Canada — Hamilton, Ontario

Die Casting specialists since 1922

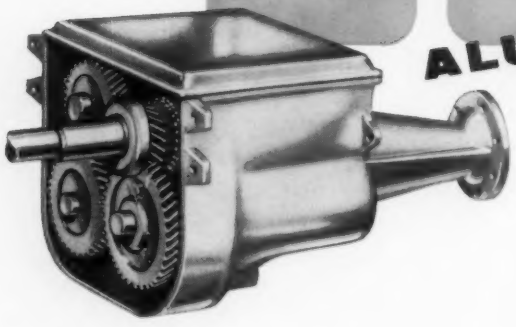
DIE CASTING *by* HOOVER

Circle No. 26 on Reader Service Card

APEX 39-11

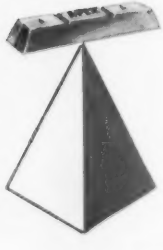
ALUMINUM ALLOY

(WITH 11% SILICON)



increases yield, saves foundry dollars on tough die casting jobs

When the die casting job calls for greater fluidity and pressure tightness, you'll be money ahead by specifying Apex 39-11. This aluminum alloy, containing 11% of silicon, consistently assures castings of uniform high quality. It permits production to proceed smoothly and results in a quality product, meeting rigid standards of dimensional accuracy. Apex 39-11 castings have good as-cast surfaces and above-average mechanical properties, too. Like all Apex alloys, Apex 39-11 is laboratory-controlled to meet industry's most rigid specifications. Here's another fine product of Apex research—one you can rely on every time!



Research leadership back of every ingot

Send for our helpful booklet, ***Die Casting Alloys.*** *Shows composition, properties, other data on Apex products. No obligation.*

Warehouse distributor of ALCAN foundry alloy ingot

APEX SMELTING COMPANY

CHICAGO 12 • CLEVELAND 5 • LONG BEACH 10, CAL.
SPRINGFIELD, OREGON (NATIONAL METALLURGICAL CORP.)

Circle No. 8 on Reader Service Card